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MODERN METALS

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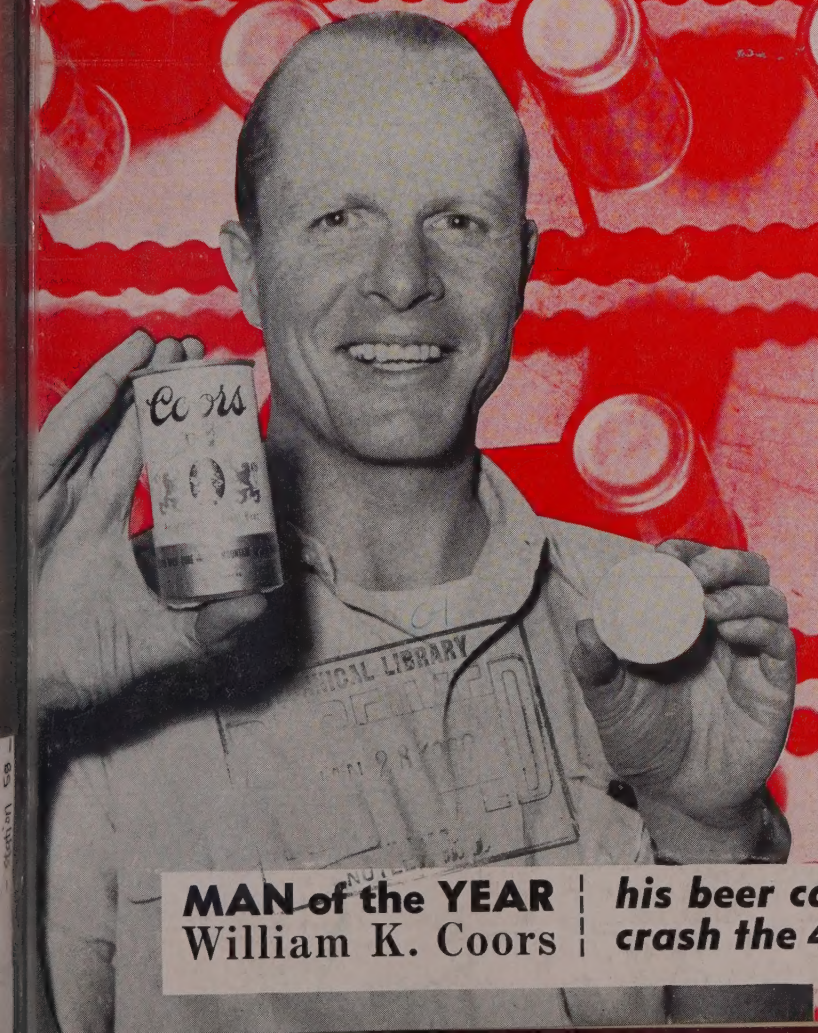

MAN of the YEAR
William K. Coors

his beer cans helped aluminum crash the 42 billion can market

(see page 88)

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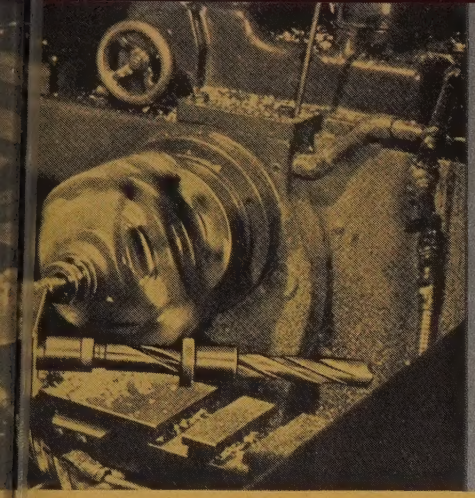


How to Machine Aluminum for Profit!

. . . higher machine speeds, greater efficiency, longer tool life

Aluminum alloys are recognized throughout the machining industry as having inherently good machinability. They cut easily at high speeds, require less machine energy, and conduct heat away from the tool point rapidly.

Points to Remember

There are five fundamental points to remember when machining aluminum:

1. *Adjust machining practice to take advantage of aluminum's excellent machinability.*
2. *Use machines that operate smoothly and efficiently at high speeds.*
3. *Adjust rake angles to alloys, use keen cutting edges, smooth tool surfaces and ample chip clearances. Support tool near cutting edge.*
4. *For roughing, use moderate to high speeds with moderate to heavy cuts and feeds. Increase speeds and diminish cuts and feeds for finishing.*
5. *Use the proper lubricant or coolant and apply copiously.*

Alloy Characteristics

Most wrought aluminum alloys have exellent machining characteristics and are well suited to the production of intricate parts and screw machine work.

Casting alloys with copper, magnesium or zinc as a principal alloying element are easily machined. Very high silicon alloys cut freely, but tend to be abrasive. Therefore, carbide-tipped tools are recommended.

Common (non-heat-treatable) alloys tend to give continuous turnings that must be directed away with generous side and top rake angles to avoid surface scratching. They cut easily and tool pressure should be light. Machinability is improved by cold working to harder tempers.

Strong (heat-treatable) alloys can be machined to a fine finish with a good coolant-lubricant recommended for most operations.

2011 is a high strength, free-machining alloy which can be machined at high speeds and feeds with a low rate of tool wear. It is excellent for screw machine operations, and is also recommended for general machine work requiring a free cutting alloy.

Tool Design

In general, tool geometry is determined by alloy hardness and temper.

Smallest rake angles can be used for free-machining alloys and roughing cuts. For example 2011-T3 usually requires a rake of 0°–3°.

Larger rake angles are required for optimum machinability of soft alloys. Wrought alloys like 6061-T6 usually need 10°–15°; casting alloys like 43, 195-T6 and 380 frequently use a rake of 15° or more.

Use the *smallest* cutting angle compatible with alloy hardness and abrasive quality to reduce tool pressure and improve finish. In most cases, clearance angles of 6°–10° are suitable.

Lubricants, Coolants, Cutting Compounds

It is good practice to use coolants and lubricants generously for longer tool life and better finishes. However, for light cuts, many aluminum alloys can be machined dry.

A combination coolant-cutting compound is a "must" for clean surfaces and close tolerances in finish machining. Remember that aluminum alloys expand from heat more rapidly than steel or brass. This makes coolants especially important.

With slow surface speeds and heavy cuts, use a compound with good lubricating properties. Cooling is a secondary consideration here. But on finishing work, where surface speeds are high and cuts shallow, cooling is vital, and lubricating not quite as important.

Use a cutting compound with moderate viscosity and good lubricating properties where cutting speeds are low and chips are heavy, where chip flow is restricted.

Use lower viscosity, coolant type compounds with higher speed operations and shallow cuts.

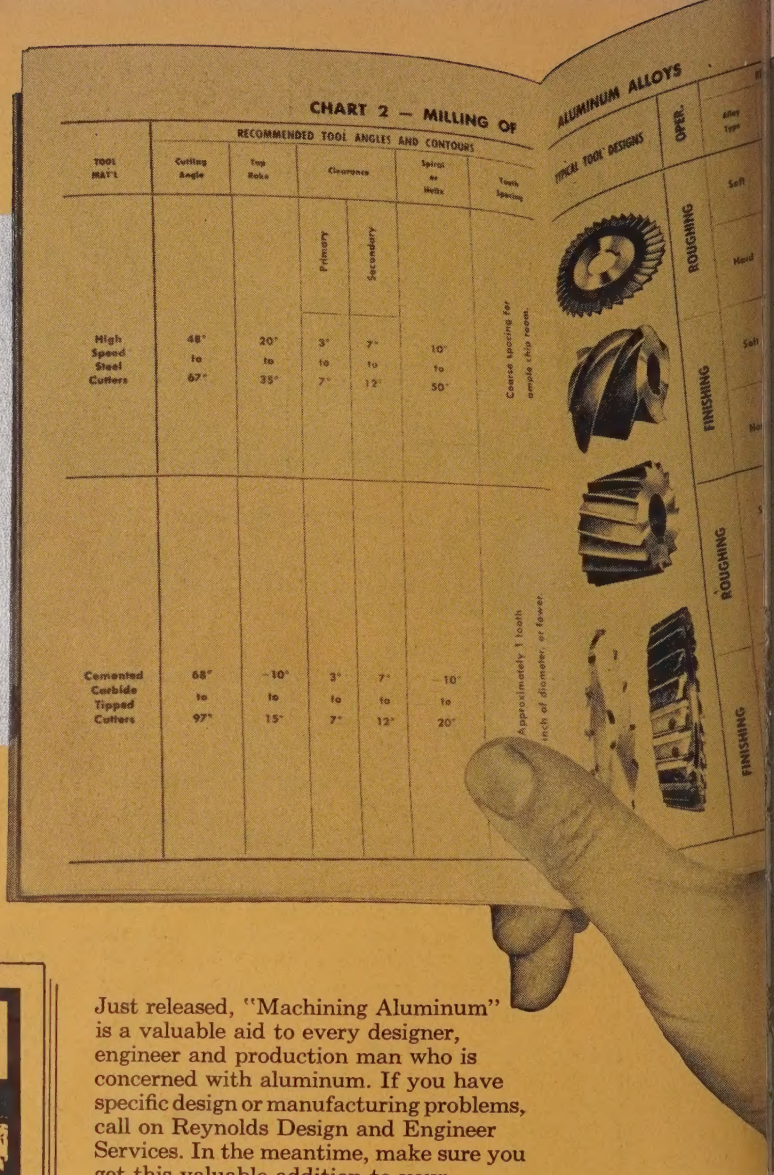
A complete handbook, with charts, tables and discussions of all the various machining operations with aluminum is offered on the next page. For more information and advice contact Reynolds Metal Company, P.O. Box 2346KL, Richmond 18, Virginia.

Watch Reynolds TV shows—"ALL STAR GOLF", "BOURBON STREET BEAT" and "ADVENTURES IN PARADISE"—ABC-TV

And, to be sure you get the right aluminum—use Reynolds Aluminum

FREE booklet, "Machining Aluminum"—see next page →

Machining Aluminum for profit!



Write for this free new 32 page REYNOLDS HANDBOOK

Just released, "Machining Aluminum" is a valuable aid to every designer, engineer and production man who is concerned with aluminum. If you have specific design or manufacturing problems, call on Reynolds Design and Engineer Services. In the meantime, make sure you get this valuable addition to your technical library. Subjects covered are:

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- Filing Aluminum
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- Reaming Aluminum
- Sawing Aluminum
- General Machining
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- Grinding Aluminum
- Charts on Tooling, Speeds & Feeds

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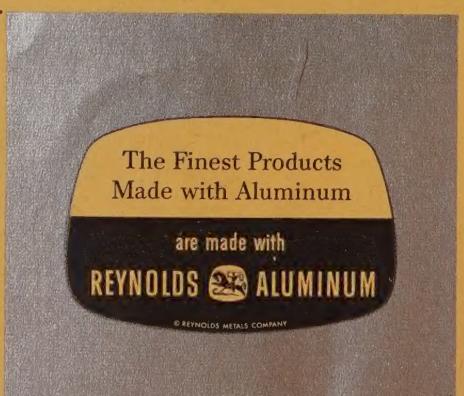

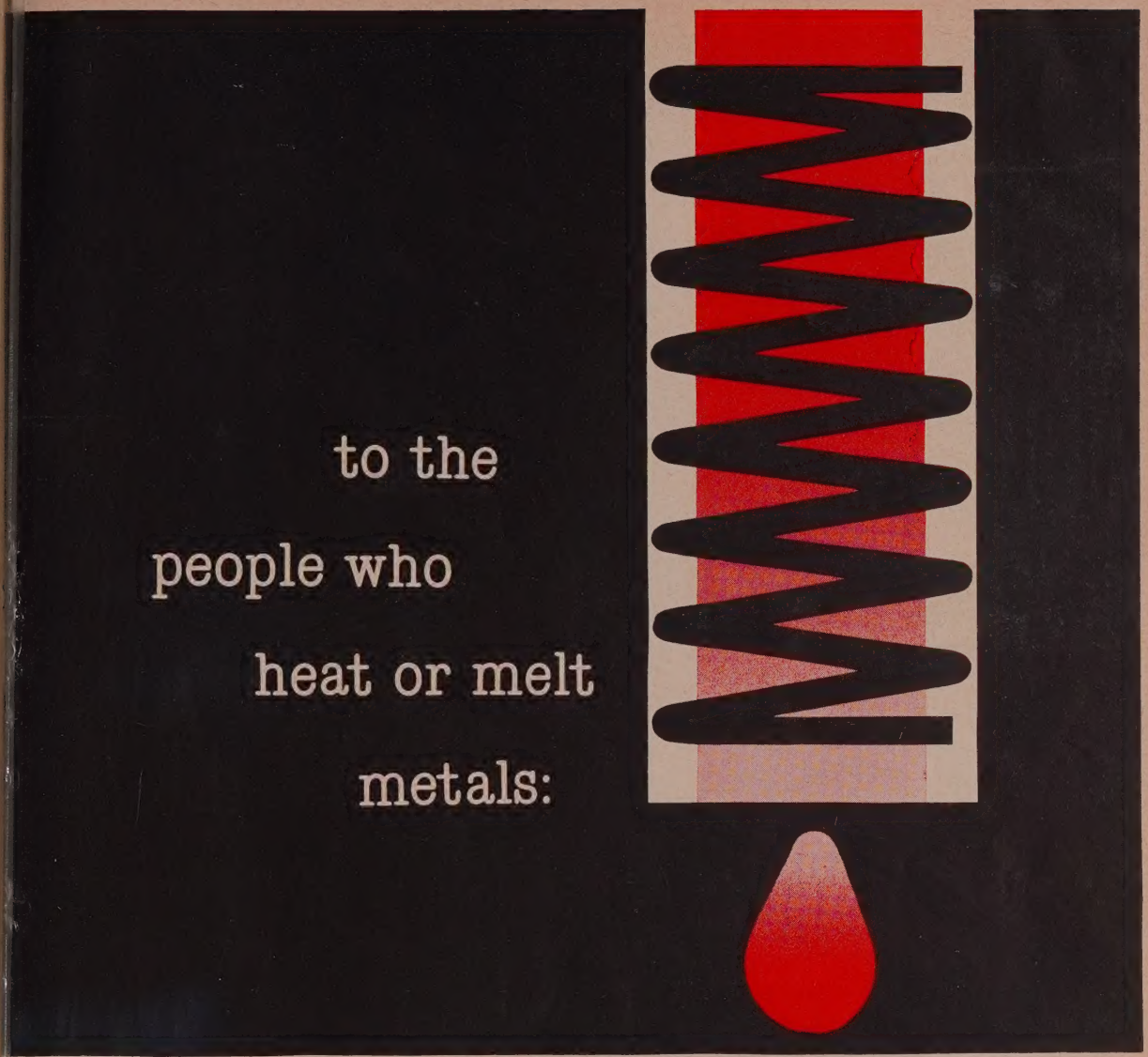

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MODERN METALS

Read in companies that produce, fabricate and cast aluminum, magnesium and titanium, and firms that use these metals in manufacturing end products.

N THE COVER: Bill Coors and the aluminum can he developed are symbols of hievement and hope for the light metal a market that grows in importance with h passing year. With the inverse reionship of steel and tin supply to an ploding world population, the aluminum could be a vital factor in supporting e in the future. The Coors story starts page 88.

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The aluminum industry can count on a substantial gain in aluminum consumption by the auto makers, thanks to the new compacts, a rising economy, and high demand.

MAGNESIUM WELDING PROBLEM SOLVED ..... C. R. Sibley **48**
High surface resistance of magnesium welding wire is no longer a problem, now that Air Reduction Co. has developed a new type of contact tube.

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Nylon mandrels and shoes, made from extruded Polypenco 101, are the new bending tools used by Lite Vent Industries. The material is easily machined at high speeds using conventional cutters.

BIG ALUMINUM DOME FOR ASM HEADQUARTERS **56**
Thirteen miles of aluminum alloy tube and tension rods were used in the new home of the American Society for Metals. The 250-foot diameter geodesic dome weighs 166,000 pounds.

ALUMINUM IN HEAT TRANSFER EQUIPMENT Harry E. Phipps **60**
The light metal is a natural for many applications in heat transfer equipment. Many considerations are discussed in this article.

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England's furniture designs have changed greatly in recent years, and aluminum figures largely in these plans.

READY TO ANODIZE THE BIG JOBS **72**
Midwest's biggest job anodizer anticipated growth of window and curtainwall design and was ready with more than adequate facilities for today's larger work.

BIG, LIGHTWEIGHT SUPERSTRUCTURE **74**
By using welded aluminum instead of steel for the eight tiers of deckhouses for the new steamer, Oriana, enough weight was saved to allow passenger accommodation to be increased to the extent of a complete deck.

HIGH PURITY ALUMINUM MELTING ..... R. D. Coen **78**
Special furnaces last longer, need less care, give more economical melting, and don't impair quality of the metal.

OUTLOOK GOOD FOR ALUMINUM THIS YEAR ..... K. B. Rhodie **80**
Just about every industry is looking forward to substantial gains this year; and because aluminum plays an important part in industry plans, the light metal also stands to gain.

MAN OF THE YEAR: WILLIAM K. COORS ..... F. L. Church **88**
Four years of developmental effort and the expenditure of a million dollars produced the first successful captive aluminum can operation in the U. S., symbolizing the light metal's penetration of the lucrative can market.

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Letters

Extrusion Die Design

Sirs:

We are finding some difficulty on the subject of designing extrusion dies for extrusion of aluminum alloys. We request you to advise us some technical literature on the subject, so that we can polish our conception of die design and ultimate utility of our extrusion press capacity which is 1250 ton for extrusion of various types of aluminum alloys at different temperatures.

"S"—India

MM—It's usually hard to find a man who pulls teeth and who is also an expert on heart disease. But it's much harder to find some literature or manuals on how to design extrusion dies.

Your best bet is to buy your dies until such time as you can find a good die designer—otherwise you're in trouble. For the best sources of extrusion dies, see our Light Metals Buyers' Directory which will appear in the February issue.

Child's Aluminum Play Chair

Sirs:

In rereading an article in the October issue of the MODERN METALS, we noticed that a subscriber from Missouri was seeking a manufacturer interested in manufacturing and distributing a new auto and play chair for children.

If this person is still interested, we would appreciate your passing our inquiry on to him so that we may follow up to a conclusion.

We have the equipment necessary to manufacture his product and the sales organization to distribute it. As a matter of interest, we did make a few stroller frames for one company to help them in their own production, which was lagging.

"J"—Canada

MM—We have passed along your letter to "M" in Kansas City. You should hear from them.

On Lubricating For Sawing

Sirs:

. . . We do not guarantee saw blades using a stick-type lubrication. If you are acquainted with all of the machinery for sawing nonferrous metals, you know they are now installing as standard equipment, either a drip of a heavy consistency, a spray, or a flood coolant with no provision for stick lubrication. What we have found out with the stick lubricant is that the first part of the cut is lubricated and as you go through the cut, the lubrication wears off entirely from the saw blade, causing a dry cut.

What is really needed is a coolant which will keep the saw body cool at all times. The type of saw blades necessary to cut the aluminum or other nonferrous metals is a high quality steel, a very fine structure and usually very hard. Using a spray or a flood coolant, the blade is kept at an even temperature throughout, permitting no expansion. However, with a stick coolant, where the rim of the blade gets warm due to the lack of a cooling action, the body remains cold and naturally the rim is going to expand and when the expansion takes place, something must give; and about the only thing it can do is to throw a radial crack in the saw. One of the

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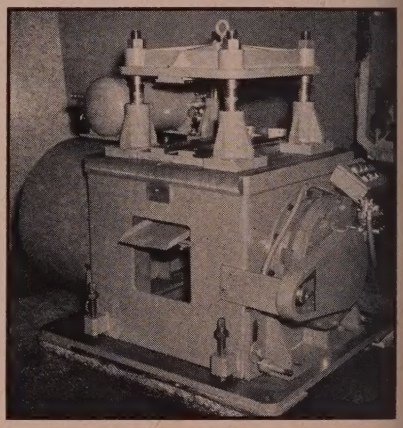

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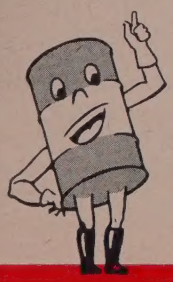

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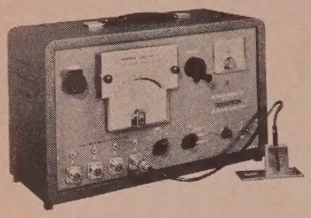

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compensators that we have for this is expansion slots. However, if the saw gets too hot, the expanion slots will not be sufficient safeguard, and cracks will occur.

As to the types of coolants necessary to lubricate a saw blade for cutting nonferrous metals, to begin with you do not need any coolant to cut nonferrous metals.

Actually, the coolant seeks to eliminate heat generation which ultimately causes galling of the metal to the saw blade. This will cause cracks. You can use any type of a lubricant—spindle oil, motor oil, soluble oil, lubricating wax or many other types of lubrication. The main point of lubrication or coolant is to get something between the saw body and the material being cut, which is slippery enough to keep the saw from picking up any metal which is being cut. Whether cutting copper, brass, aluminum, or bronze you get the same trouble as with an improperly oiled piston in an automobile. If you run an engine with oil, the piston going up and down will work perfectly well and will not gall. However, the minute the lubrication gets bad or there is a lack of lubrication or an overheat, the piston or the rings will gall upon the cylinder block which is what happens to a saw blade.

"G"—Ohio

MM—This letter, from a prominent saw blade manufacturer, resulted from a discussion of a new stick-type lubricant for extruding and cutting aluminum.

Whenever we see something new come along we are naturally anxious to expose its merits to potential users. It's advantageous to hear what is good about a product; also its drawbacks. Thanks for your interesting letter.

Gold on Aluminum

Sirs:

On page 78 of your December issue, there is an article on the Rheingold treatment which can give aluminum any golden or silvery hue.

The article indicates that the process was developed by the Shiraishi Laboratory Inc. of Tokyo.

Can you tell us the name and address of the U. S. representative for this process?

"D"—Wisconsin

MM—This refers to a news items from Japan that introduced a simulated gold finish on a variety of aluminum products. The samples they sent along were of high quality; looked interesting.

The company does not have an office in the U. S. A. but can be reached by writing: Shiraishi Laboratory, Inc., 4-7 Kojiyamachi, Ohtaku, Japan.

Aluminum Flagpoles

Sirs:

In the November issue of MODERN METALS, a letter to the editor requested information on manufacturers of aluminum flagpoles.

The only suggested manufacturer that you listed was Hubbard & Co. of Pittsburgh, Pa. The Hubbard Co. is one of our competitors and an excellent firm. However, they do not manufacture flagpoles as such. But there are various manufacturers such as the John E. Lingo & Son Co., Camden, N. J., and the Babcock-Davis Co. of Boston, Mass.

"J"—New Jersey

MM—Now everyone knows where to get good flagpoles. Thanks very much.

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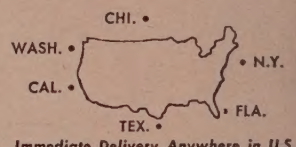

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Sandusky Foundry and Machine Company did...

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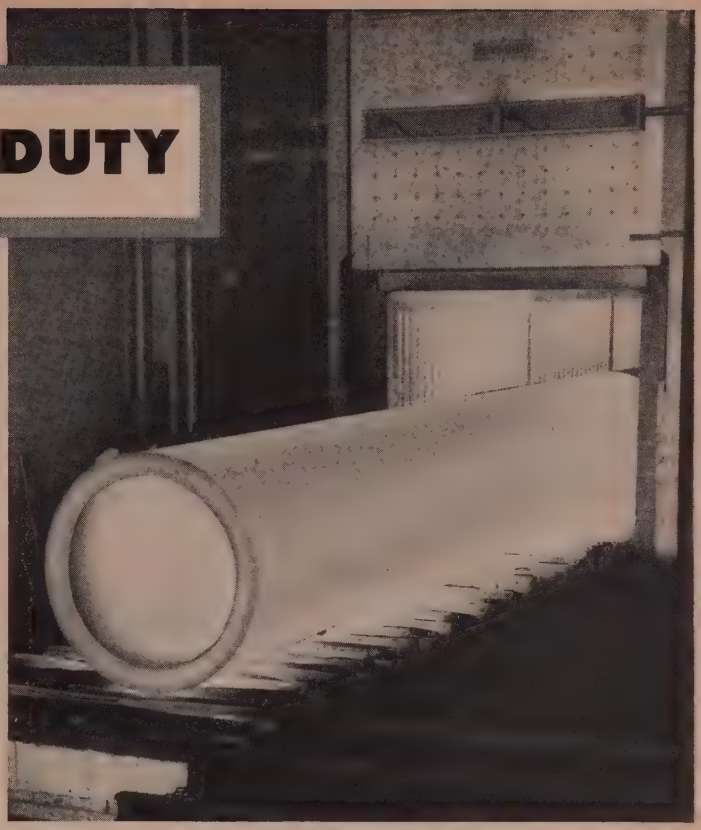

Sandusky Foundry and Machine Co. selected this Hevi-Duty Electric Car Bottom Furnace, rated at 2050° F. for their heat treating requirements. Casting being heat treated here weighs 13,700 lbs.

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The Hevi-Duty Car Bottom Furnace features five zones of temperature control, and by placing a dividing wall between the three forward and two rear zones, two separate loads with different temperature ranges can be treated simultaneously. Heating elements in side and end walls, ceiling, door and car bottom, plus three removable air-circulating fans help provide uniformity of temperature.

Whatever your particular heat treating application, there's a Hevi-Duty furnace designed to do the job. Car Bottom Furnaces are available with many arrangements and optional features—single or double end, retort type, controlled atmosphere, forced-air convection and others. Be sure to contact Hevi-Duty first for your heat processing equipment needs.

HEVI-DUTY

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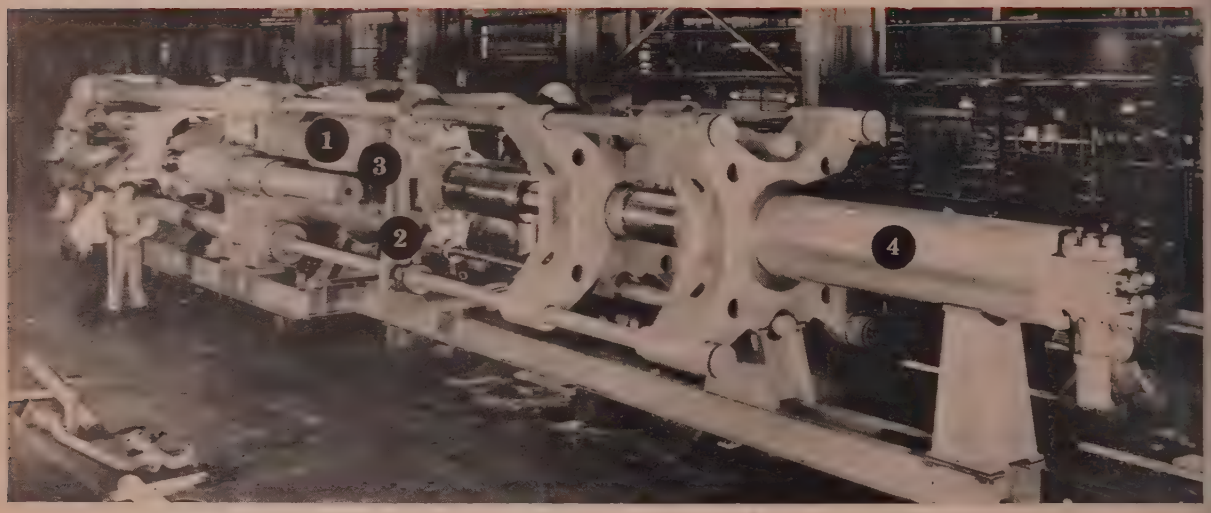
The precise reasons why Loewy extrusion presses offer the maximum in production, economy, endurance, flexibility



3000-ton-capacity water-hydraulic extrusion press with independent external piercing device

1. Inserted forged steel main cylinder
2. Simultaneous setting of stop nuts by chain attachment mandrel arresting device
3. Prefill valve connector of patented design
4. Inserted forged steel piercer cylinder

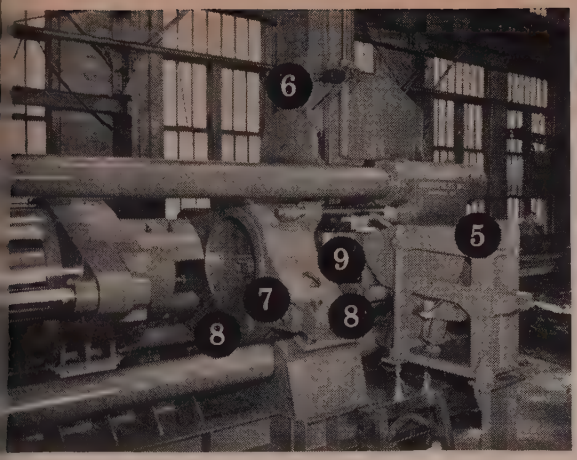
Many of the outstanding features of Loewy extrusion presses are a result of anticipating the needs of our customers. Others, of course, stem from special designs made to satisfy the requirements of a specific client. The principle of changing basic designs to meet individual requests has resulted in presses that offer maximum production, economy, endurance and flexibility.

Loewy presses can handle all extrudible metals and alloys. They allow a combination of the variable operating conditions of pressure, speed, temperature and billet size needed for a perfect product. They are, moreover, built for the utmost economy of man-hours, cycle time, horsepower, maintenance and floor space.

In our designs, pushbutton automatic control has been developed to the highest degree of functional perfection. Extrusion speed adjustment, billet, dummy and cleanout disc handling, die change and rotation—all can be fully mechanized.

Rigid welded steel construction insures utmost precision in alignment and, where tubular products are concerned, highest concentricity. One-piece design of larger components prevents warping at high operating temperatures. Auxiliary movements are provided with independent pressure supply.

The pictorial story presented here sets forth some of the features of Loewy extrusion presses, all of which are the product of many years' study, research and development. And many other important advances are currently in the making. For detailed information, write Dept. D-1.



00-ton-capacity self-contained oil-hydraulic extrusion press

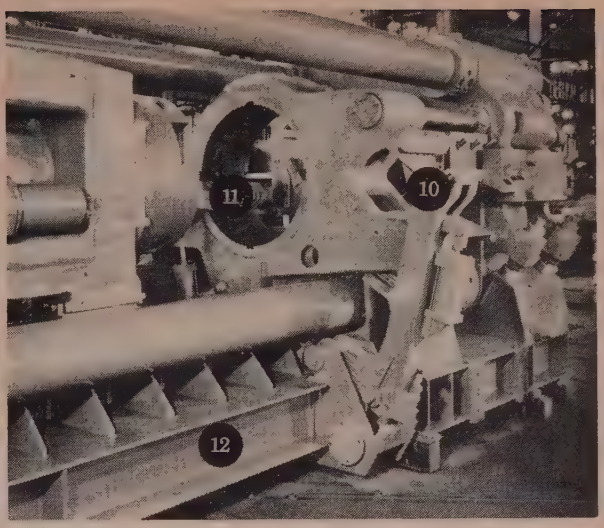
Mechanized die-changing device permitting use of several dies rotation without manual die changing and without interrup- n in main press cycle

Vertical sliding butt saw with oil-hydraulic feed control

Movable container holder of one-piece design that will not ırp under influence of heat

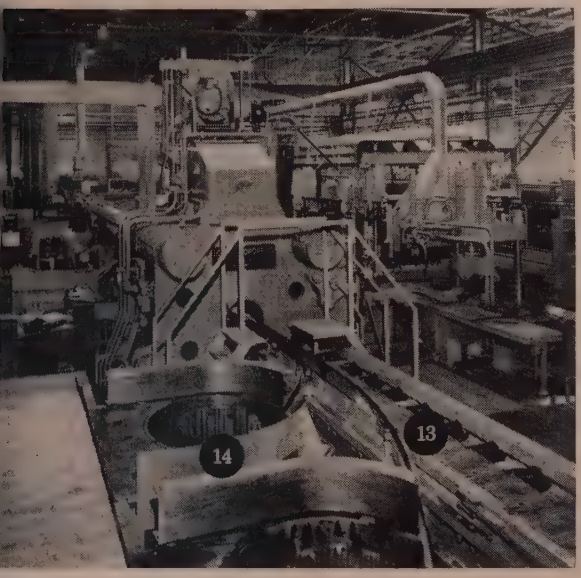
Adjustment that insures concentric alignment

Lateral die slide, hydraulically operated, with two stations for ɔ assembly and for removal of butt and shell



3000-ton-capacity water-hydraulic extrusion press with internal piercing device

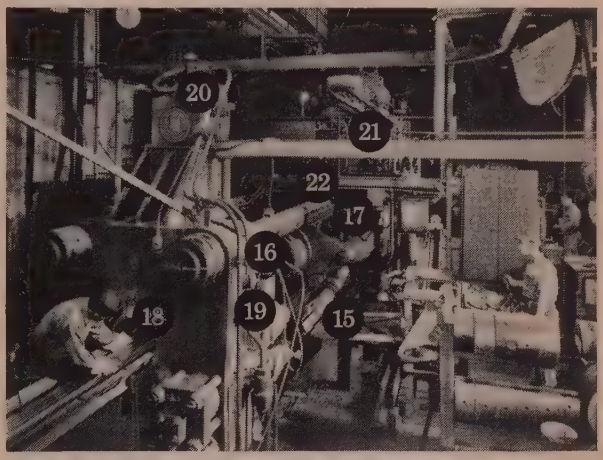
10. Billet loader of robust pivot-arm design
11. Cleanout disc loading device mounted in front of container.
12. Base frame—one-piece design of rigid welded construction that facilitates alignment of press assembly



)00-ton-capacity water-hydraulic extrusion press

3. Mechanization of run-out side of press for straight solid and bular extrusion

4. Double coiler designed for the wire rod to be received near e outlet of the press



2200-ton self-contained oil-hydraulic extrusion press

15. Simple, easily adjustable billet loading device
16. Container holder designed to permit fast change of container, which can be removed on return press stroke
17. Ram speed indicator
18. Large platen hole for ease of access to emerging extrusions
19. Heavy-walled pipes rigidly supported to cut vibrations, leaks
20. Powerful, rigidly constructed shear
21. Large oil reservoir for minimum operating temperature
22. Full-size catwalk for ease of maintenance

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HARVEY Aluminum

Here and There

Building Sheet Making Good? » » Aluminum building sheet, controversial product introduced last October by Aluminum Co. of America, is achieving beachheads in important areas.

Richard A. Sweet, Alcoa's manager of sheet and plate sales, said the new sheet product, fabricated and priced to compete with less expensive conventional materials, now is moving in substantial volume to manufacturers of a variety of products. Cited among the applications were awnings, carports, louvers, wall panels, building corners, prefabricated chimneys, silo roofs, water heater jackets and window air conditioner cabinets.

"The trend supports Alcoa's conviction that aluminum can penetrate areas in which its use has been negligible, if we offer its superior qualities at an advantageous price," Sweet said.

Alcoa, in announcing the availability of building sheet, stressed that it is a new high-volume standard item, produced in specific thicknesses from one alloy. It is rolled in coils, or in "leveled cut to length" sheet. The ability to make large mill runs of this product enables the producer to establish a price on minimum orders of 100,000 pounds that is more realistically competitive in the market.

Sweet pointed to window air conditioner cabinets as an application in which building sheet is helping the aluminum industry capture a market previously dominated by steel because of the heavier metal's relatively lower cost.

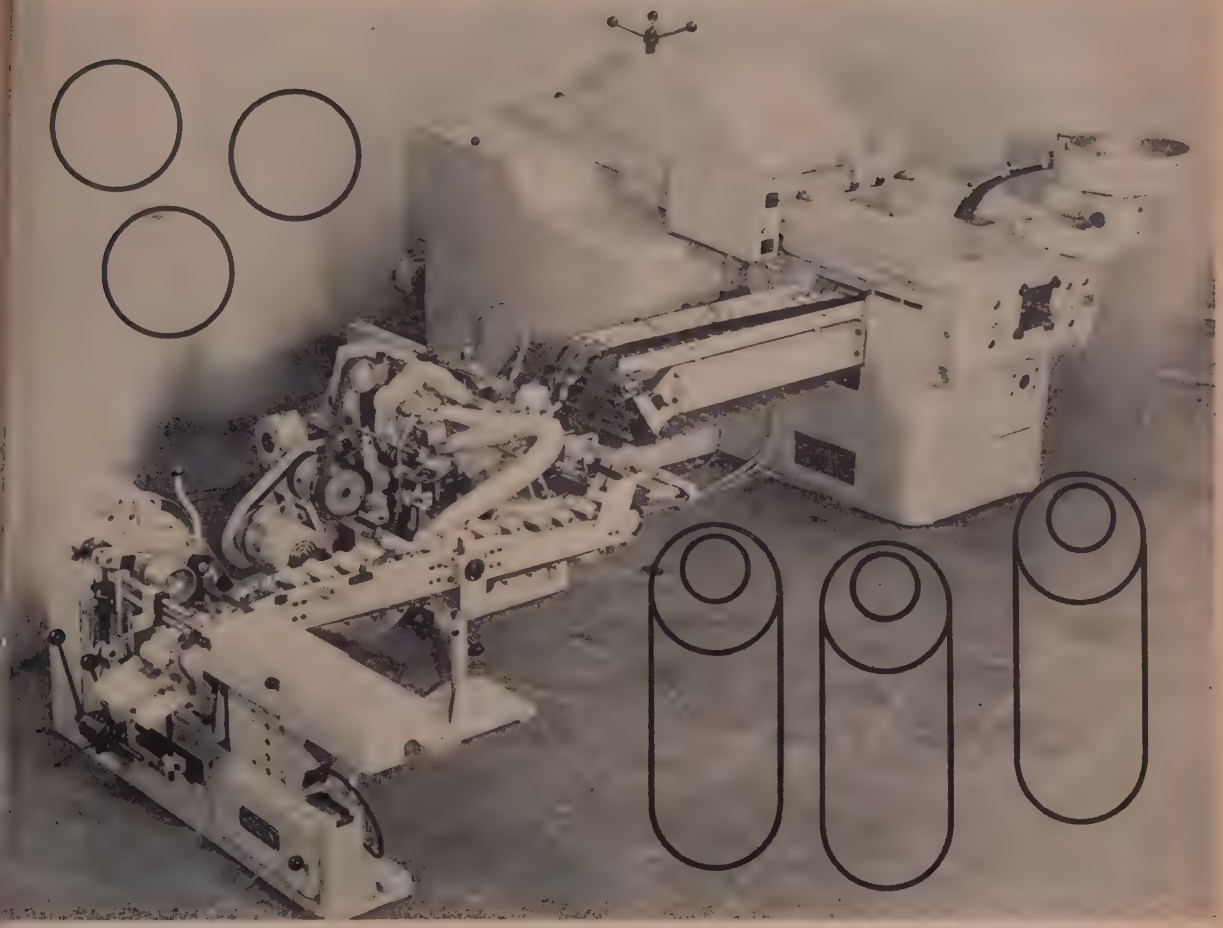
"Many home owners and building owners have complained of stains from window air conditioners encased in conventional materials," Mr. Sweet said. "Now that several major air conditioning manufacturers can have the light weight, corrosion resistance and attractiveness of aluminum at a competitive price, they're switching to building sheet."

Mr. Sweet added that one of the country's largest producers of hot water heaters plans to switch its entire production of tank jackets from painted steel to aluminum. The strength advantages of building sheet, which are superior to most alloys currently employed in building products, plus the availability of mill-coated enamel finishes, were cited as factors favoring aluminum in addition to its competitive price.

Manufacturers of ventilators, grass stops, patio enclosures, ducts, door kick plates, furnace filters, frames, and pipe jacketing, also are evidencing an intention to substitute aluminum building sheet for previously used forms of steel.

Big New Outlet for Homes » » The new year finds some 1600 independent lumber dealers poised to sell a line of aluminum prefabricated homes. The move, in the words of Clarence A. Thompson, president of the Lumber Dealers Research Council, "will enable Lu-Re-Co dealers and their home builder customers to meet the big two-pronged challenge of 1960—increasing prefabrication and the swing to aluminum construction." Lu-Re-Co, it should be noted, is a wing of the National Retail Lumber Dealers Association which was organized to help the Association membership "remain competitive in the face of increasing prefabricated housing and large tract building operations which threaten the very existence of the local dealer and the smaller builder" (Mr. Thompson speaking). There will be five models in the group which will be called the Independence Line—ranging in price from $8,000 to $13,000, exclusive of land. All but one of the five models will feature two or more baths. Reynolds Metals Co. or Reynolds manufacturing customers will

HERLAN HORIZONTAL IMPACT EXTRUSION PRESSES



Impact extruded aluminum aerosol cans . . . from slug to completed shell automatically.

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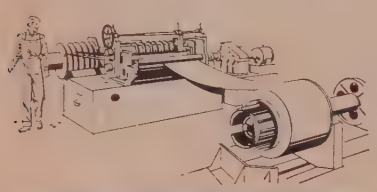

YODER ROTARY SLITTING LINES

supply the many aluminum building products for these homes. Lu-Re-Co expects that more than 500 of the Independence line homes will be built and displayed throughout the U.S. as model homes this year. Incidentally, speaking of the importance of the lumber dealer in the distribution of aluminum building products, J. C. Neeley, Reynolds' director of building products markets, said, "Lumber dealers, more than anyone else, stand to benefit from the soaring demand for aluminum building products. The Reynolds program will help them maintain and strengthen their position as the local builder's traditional source of supply in the complex and sometimes chaotic field of building products distribution."

Report from Canada » » Aluminium Limited is moving steadily toward a production rate that will total 675,000 tons during 1960. This output would represent 87% of the company's installed capacity. "Limited's sales in 1959 totaled about 635,000 tons, an increase of 10% from 1958, reflecting an accelerating improvement in our business, particularly overseas," Nathanael V. Davis, president, said. He said that planned Canadian output combined with that of overseas subsidiaries and contractual acquisitions from other sources would enable the company to fill present orders and provide a reserve for further possible sales increases. Eric F. West, president of Aluminium Limited Sales, Inc., New York, said there is "abundant evidence of renewed vitality in the consumption of aluminum." Looking back at 1959, West noted a narrowing gap between supply and demand, and a continuation of this trend this year. "We have been able, recently, to expand our reduced production levels," West said. "For several years we have been developing a project to add 1,000,000 h.p. of hydro-electric power to our industry in the Saguenay area, correlating this with increased facilities in the Caribbean to handle bauxite and aluminum. This will enable us eventually to expand our Canadian aluminum smelting capacity to 1,000,000 tons, at a relatively low cost, when market conditions in the U.S. and elsewhere warrant." West noted wider acceptance of aluminum in all fields, noting particularly the metal's recent successes in the railroad industry, a field where Limited has labored long and hard for greater use of aluminum in rolling stock. "The latest development, in 1959, was the acceptance by the Association of American Railroads of the all-aluminum hopper cars for interchange on U.S. railroads," West said. "Incidentally, the aluminum cars are eight tons lighter than their steel counterparts."

Meanwhile, in West Germany » » where they contribute about 3.6% of world capacity and usually produce about 4% of the world's primary aluminum, they will have to depend more and more on outside production to satisfy their primary aluminum and aluminum scrap requirements, the German American Chamber of Commerce reports. West Germany accounted for close to 7% of world consumption in 1958. That year German production slumped to 137,000 tons from a high of 157,000 tons during the preceding year. However, secondary production rose from 90,000 tons to 102,000 tons for a total domestic supply of 239,000 tons—slightly under the total of 244,000 tons the previous year. But total consumption of aluminum zoomed to 287,000 tons in 1958, according to the Chamber. This was about 14,000 tons more than was consumed in 1957 and generated imports of 69,000 tons of primary metal and aluminum alloys. The trouble is that present production facilities are already using all of the electric power available at a cost which makes production feasible. Present primary capacity is about 180,000 tons; 1959 production is estimated at about 150,000 tons. To encourage imports of the light metal, the West German government has established a duty free import quota of 40,000 tons annually.

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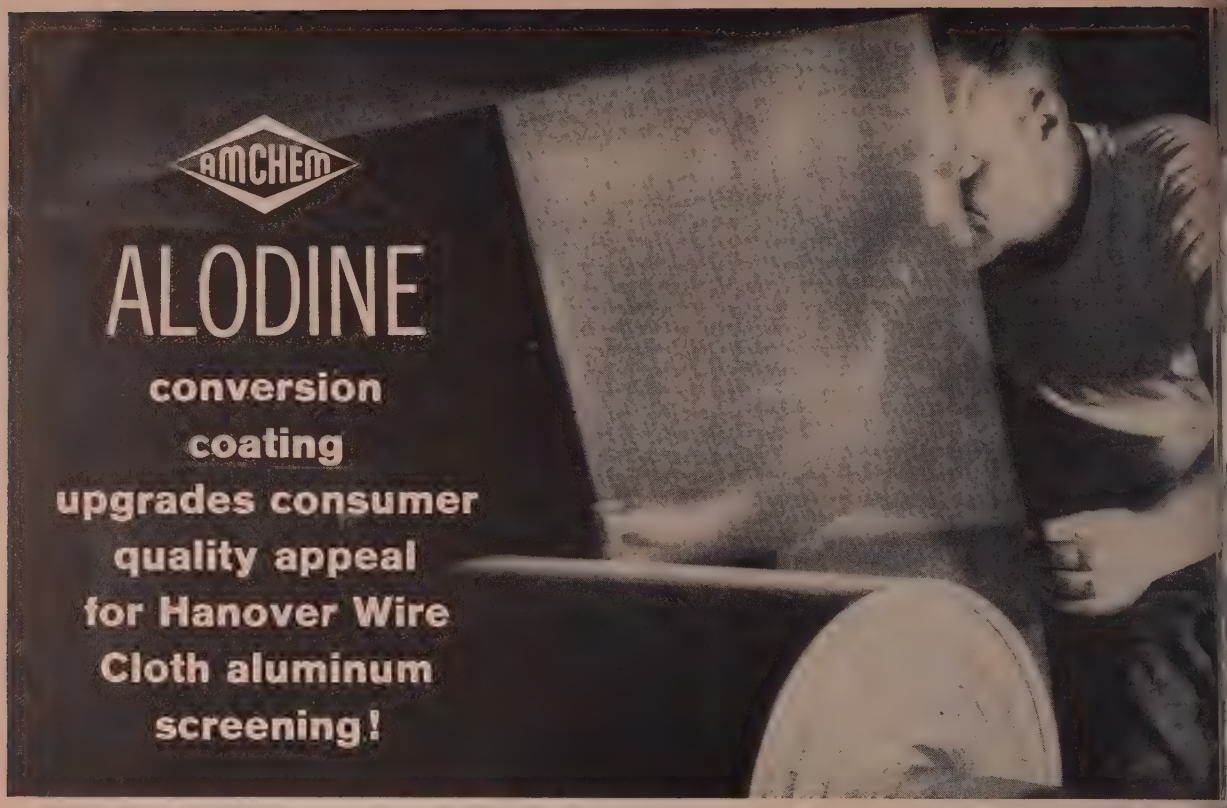


At big aluminum screening producer, Hanover Wire Cloth, Amchem Alodine has racked up a performance record far beyond the call of duty for chemical conversion coatings! The result—a line of non-glare, corrosion-resistant, color-fast aluminum screening that's making a startling impact in trade and consumer circles.

Use of Alodine at Hanover has the unqualified support and enthusiasm of management. E. B. Frock, Continental Copper & Steel Industries Vice President in charge of the Hanover Division terms Alodized aluminum "the screening of the future," that "eventually all aluminum screening will have to be treated before it is painted or finished, and Alodine is the better answer."

Hanover salesmen have proven Alodine's superiority as a sales tool in the field with a product benefits story that has been justified in actual use. Alodine-treated screening with its non-glare, corrosion-resistant, color-fast advantages has found immediate consumer acceptance for use in windows, doors, jalousies, carports, patios and swimming pools. Acceptance (and sales) of Alodized screening has been heavy nationwide, enabling Hanover to improve an already strong distribution position. Seashore use is particularly popular due to the ability of Alodine-treated screening to withstand the long-term corrosive effects of wind, salt and sun with amazing wearing qualities.

Hanover employs Alodine in an Amchem-developed and designed 5-stage system processing 903 foot rolls of Imperial screening in charcoal gray and soft green finishes at normal line speeds of 25 feet per minute in the 105-110 degree temperature range. Plans are being implemented to put Hanover on tandem roll operation. Automated chemical feed is currently being installed. Technical assistance by Amchem Representatives in setting up Alodizing operations on a production basis have resulted in bringing processing costs to a level reasonably competitive with standard or conventionally finished aluminum screening.

Strongest proof of Alodine-treated screening quality is found in the decision of one important Hanover customer to stock Alodized only and offer this one screening exclusively for the 1960 season. Hanover management, alert to consumer buying trends, looks ahead to the day when its entire output of screening will be *Alodized with Alodine* to provide in quantity this increasingly popular, uniform finished aluminum wire cloth.

The Hanover executive team examines roll of Alodine-treated aluminum screening. Left to right: R. C. Ampspacher, Production Manager; A. Y. Wolff, General Manager; Richard Bamford, Sales Manager; and E. B. Frock, Vice President.

At beginning of the Alodine processing line, worker adjusts screening as it enters. Tandem processing is planned since wide tanks will accommodate many widths in tandem. Automatic chemical feed is being incorporated into system.

At the end of the 5-stage Alodine processing line the chemically treated wire cloth is subjected to visual spot checking as it is rewound into 903-foot rolls.

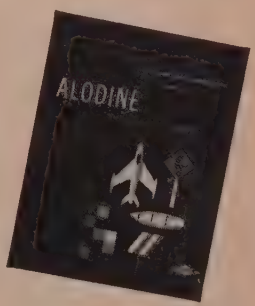
"Imperial" Alodized aluminum wire screening is packaged at Hanover Wire Cloth for shipment to customers nationwide. Each carton bears special Alodized label.

Unretouched photo shows remarkable see-thru-ability of Alodized screening used to enclose carport.

Photos and facts by Commercial Photography Division, United Press International.

The story of how Amchem Alodine helped Hanover Wire Cloth move out in front with new trade and consumer benefits appeared in the editorial pages of Modern Metals Magazine, November 1959 issue. If you'd like to learn more about how Amchem Alodine can help lend consumer appeal to your products, write for a reprint of the above article, or contact your local Amchem Representative!

Write for Bulletin 1424A describing uses of Alodine for aluminum fabrications of all types.



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Useful Data

Aluminum casting alloy engineered to provide high strength without heat treatment is discussed in booklet by Federated Metals Div'n. Included are physical properties, charts showing mechanical properties and natural aging curves of alloy cast in sand mold. Sixteen special features and characteristics are listed. For copies address E. Friedlander, Federated Metals Div'n of American Smelting and Refining Co., 120 Broadway, New York 5, N. Y.

Metal processing equipment of Pennsalt Chemicals Corp. is described in new 15-page booklet. Range of machines, materials and manpower services offered by firm are given. Company's lines include metal cleaning, coating and lubricating compounds, and washers, coating and phosphatizing machines, drying and paint ovens, paint spray booths, etc. Brochure also discusses custom-finishing systems. Copies are available from R. T. Mills, Pennsalt Chemicals Corp., 3 Penn Center, Philadelphia 2, Pa.

Latest information on **aluminum alloys and the extrusion process** is contained in booklet by Precision Extrusions Inc. Booklet includes alloys, mechanical properties, recommended uses and reference numbers. Various basic extrusion types are detailed, along with standard tolerance and pricing factors. Address requests to Len Ziehm, Precision Extrusions Inc., 721 E. Green St., Bensenville, Ill.

"Riveting Aluminum" is a 52-page book by Reynolds Metals which covers use of conventional and special rivets and explains design and fabrication of riveted joints. Tables list weights and dimensions of aluminum rivets, recommended rivet lengths, mechanical properties of wrought aluminum alloys, and other data. Write on company letterhead to Reynolds Metals Co., Dept. PRD-23, Richmond 18, Va.

High strength ductile casting alloys are detailed in new Kaiser Aluminum Co. booklet. High purity alloys, X357, A356 or C355, can be used to design and produce permanent mold and sand castings. Booklet tells how company is able to minimize impurities so that these casting alloys are able to permit high temperature artificial aging to develop full strength potential without brittleness. Booklet can be requested from Kaiser Aluminum & Chemical Sales Inc., Dept. P-122, 1924 Broadway, Oakland 12, Calif.

Designing with honeycomb is covered in a handbook by Hexcel Products Inc. "Honeycomb Sandwich Design" offers a summary of sandwich design methods complete with formulas and worked-out examples for stress computations on typical sandwich structures. Sections include Sandwich Theory; Impact; Fatigue; Creep; Environment; Selection of Facings, Adhesives and Core Material; Surface Preparation for Bonding; Tooling Methods; Quality Control; etc. Illustrated

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Aluminum is not new to Scovill. We were one of the very first mills in the country to start processing this new metal when it became commercially available in the late 1880's. But commercial Aluminum Sheet produced to the same closely controlled specifications Scovill established for Brass Strip was a NEW IDEA when we introduced TRUSPEC Aluminum.

Fabricators have long wanted Aluminum like this . . . because it can so effectively help them control such common problems as "earing" and "orange peel" effect . . . because it can reduce time-consuming adjustments and promote longer tool life . . . because Scovill has made available long-length coils (up to 100 lbs. per inch of width) and the sheet itself is remarkably uniform in gauge, from side to side and end to end.

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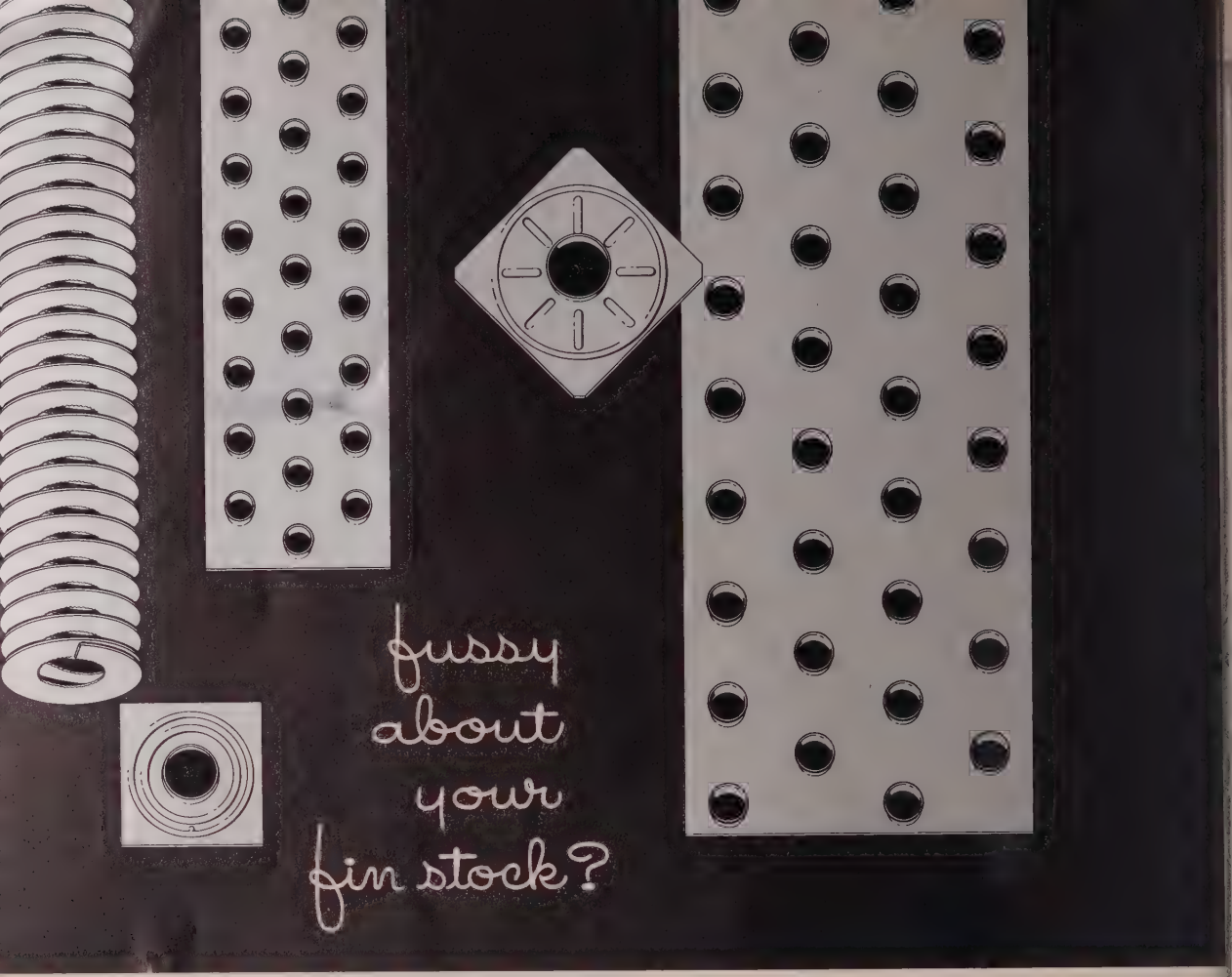
Scovill Manufacturing Company, Mill Products Division, 99 Mill St., Waterbury 20, Conn. Phone PLaza 4-1171.



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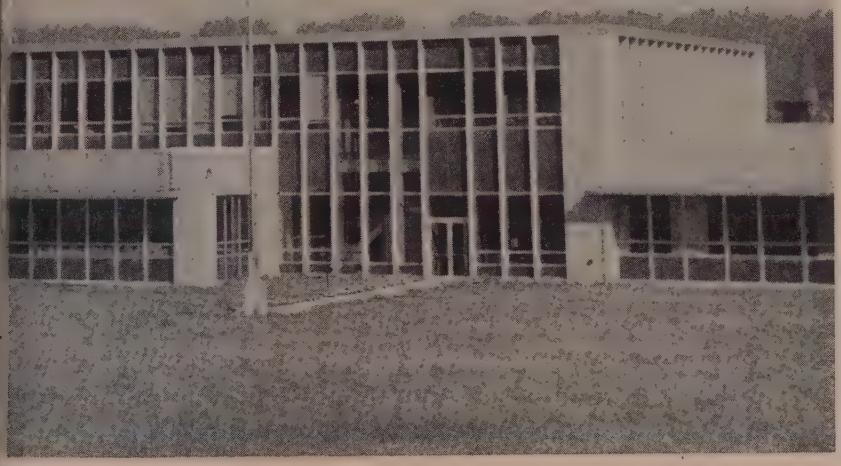

Butyrate lacquers provide clear, weather-resistant coatings that won't yellow, even under prolonged exposure to sunlight. They have high strength and flexibility ...withstand oxidation and discoloring...and are little affected by salt spray or rapid temperature changes.

When outdoor aluminum surfaces are protected with Butyrate lacquers, cleaning and maintenance costs are at a minimum. Usually, the action of rain itself is enough to keep aluminum surfaces clean.

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Butyrate lacquers are easy to spray on, economical to use. A single coat provides excellent protection. They are available from lacquer manufacturers in all parts of the country.

An informative 15-minute 16mm. sound color film has been produced especially for viewing by those who design in or specify aluminum in an outdoor application. Would you like to see it? See below.

The aluminum exterior of the American Sterilizer Company plant at Erie, Pennsylvania, is protected against weather and oxidation with a clear, colorless Butyrate lacquer.

The finest lacquers for aluminum are made with

Eastman BUTYRATE

SALES OFFICES: Eastman Chemical Products, Inc., Kingsport, Tennessee; Atlanta; Chicago; ncinnati; Cleveland; Framingham, Massachusetts; Greensboro, N. C.; Houston; New York; St. Louis.
West Coast: Wilson Meyer Co., San Francisco; Los Angeles; Portland; Salt Lake City; Seattle.

ALUMINUM FABRICATORS

HERE'S HOW TO GET the complete story on this new method of preserving exterior aluminum.
1) Send for Eastman's catalog on Butyrate lacquer. It tells you where this new protective coating has proved particularly successful and why these lacquers are so effective in preserving aluminum surfaces.
2) Check Sweet's Industrial Construction File, Sweet's Architectural File, or see 15-M of the A. I. A. Alphabetical Filing System for specification details.
3) Send for sound color film. Please indicate the date you plan to show the film and an alternate date.
4) Write for names of manufacturers of Butyrate lacquer.

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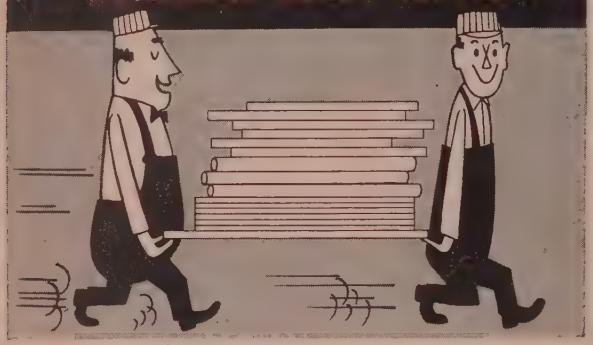

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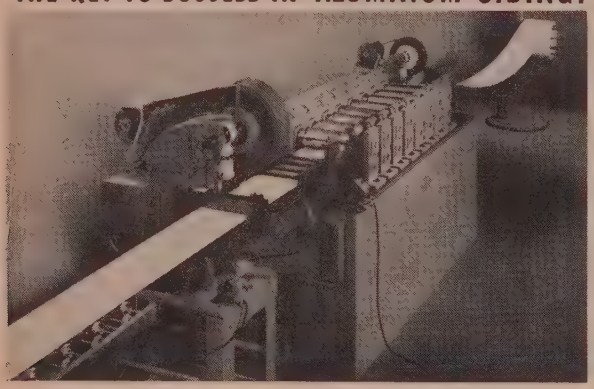

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- **The finest Aluminum Siding Production Line**
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- **Complete line of Accessories and Components**

Find out how practical and simple it is to become an Aluminum Siding Manufacturer with the Color Bound Method. This plan was developed by the foremost designers of Aluminum Roll Forming Equipment and encompasses all phases from simple manufacturing right through the ultimate sale to the consumer.

For full information about the Color Bound Plan, write to:

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ARNOLD METALS & MACHINERY INC.

596 River Road, Clifton, N. J. PO-815

publication includes graphs and charts, and extensive bibliography. For copy send 50c to Hexcel Products Inc., 2332 Fourth St., Berkeley, Calif.

Rolls and roll forming equipment are detailed in brochure by Michigan Roll Form Inc. All specifications are given for cut off and notching machines, roll form machinery, cut off and prenotch dies and roller dies. Examples of roll form set-ups designed by firm are illustrated. Special components included in machines are listed. Contact Melvin Reinhard, Michigan Roll Form Inc., 8950 Hubbell St., Detroit 28, Mich.

Aluminum perforated trim by Bohn is shown in colorful folder. ALdec is made of aluminum of one-piece construction in lengths up to 21 feet and widths to 12 inches. It can be finished by normal processes available for aluminum. Built-in ribs give longitudinal stiffness and framing section is integral part of grille. Write R. C. Aylward, Bohn Aluminum & Brass Corp., Detroit 26, Mich.

Pre-paint treating equipment for metals is subject of brochure offered by Neilson Chemical Co. Line includes rust remover, metal cleaner and phosphate coating products for preparing metal for manual, dip tank, steam gun and spray washer application. Information on phosphate and oxide conversion coatings for aluminum is given. Write R. F. Neilson, Neilson Chemical Co., 2300 Gainsboro, Detroit 20, Mich.

The **magnesium alloys** of Dow Chemical Co. are detailed in special booklet, and various uses described. All properties are tabulated in three-category table: sheet and plate, extrusions and castings. Discussion is also provided on these areas. Other information is given on tooling and tread plate, forming, machining, joining and finishing. Write W. J. Richards, Dow Chemical Co., Midland, Mich.

The Shaw process of investment casting is covered in an article reprint made by Permanent Mold Die Co. This investment molding process has made castings weighing from 1 to 45 pounds, and larger ones through the cooperation of other firms. The use of epoxy resin patterns is detailed, as are other facets of the operation. Copy of "The Shaw Process Foundry" is available from Howard Wright, Permanent Mold Die Co., 2275 E. Nine Mile Rd., Hazel Park, Mich.

Metal cutting products are subject of catalog by Heinemann Saw Corp. Specific cutting data is given for aluminum and other nonferrous metals. Products described include carbide tip saw blades, saws for nonferrous metals, portable hand and friction saws. Diameter and thickness specifications, and number of teeth, are given for each item. Catalog can be had from W. F. Heinemann, Heinemann Saw Corp., Canton 6, Ohio.

Spot welding of magnesium is covered in one article in "Resistance Welding at Work," publication of Sciaky Bros. The many aspects of welding this light metal for

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The development of LANLY HI-TEMP PANELS made possible this aluminum billet homogenizing furnace.
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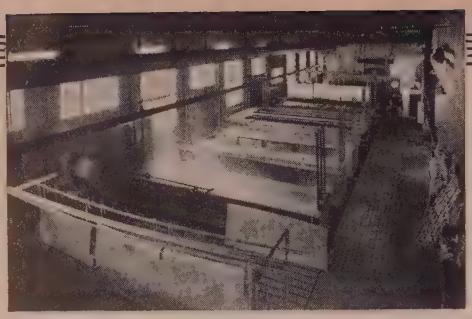

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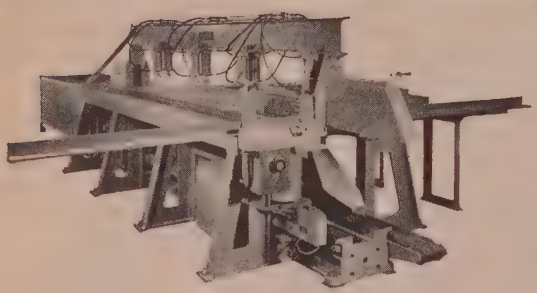

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For cutting aluminum, bronze, micarta, copper and other nonferrous metals . . . adaptable to individual requirements, yet provides economy of operation . . . satisfies rigid demand for accurate work and fast cutting. Send for illustrated folder giving full details.

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missile and rocket uses are detailed and well illustrated. Typical machine settings for various thicknesses are listed, while techniques are discussed. For copy, write W. S. Rudin, Sciaky Bros. Inc., 4915 W. 67th St., Chicago 38, Ill.

Non-ferrous tubing, and operations for cold forming and welding it, are treated in Yoder booklet. Metals discussed include aluminum and its alloys, magnesium, brass and other copper alloys, nickel, Monel, Inconel, etc. Book touches on welding speeds, how welding operation is completed, weld quality, weldability and heat treating. The importance of light gages is discussed and completely integrated mill process including strip preparation, tube forming mill, welder, cooling, sizing, straightening and cut-off is detailed. The same process can be adapted to aluminum cable sheathing. Copy available from Dick Burt, The Yoder Co., 5539 Walworth Ave., Cleveland 2, Ohio.

Metal castings are said to be improved through use of Dag colloidal graphite dispersions to lubricate casting machines and plant equipment. Nine such dispersions are discussed in booklet published by Acheson Colloids Co., Port Huron, Mich. Mixtures can be used for permanent coating molds, for chills, for die casting die cavities and for stop-off coatings. Special advantage of coatings is graphite content which offers heat resistance and high temperature lubrication.

Where and how to use aluminum for welding, brazing and soldering is the subject of charts offered by All-State Welding Alloys Co. Tensile strength, recommended joining material, percent elongation and typical uses are given for 24 alloys. In addition to basic chart various other tables show composition, give data on melt and flow temperatures and recommend filler materials for Tig and Mig welding of aluminum alloys. Another table helps worker select right solder and flux for joining aluminum to aluminum and to dissimilar metals. Contact R. H. Mandel, All-State Welding Alloys Co., Inc., 249-55 Ferris Ave., White Plains, N. Y.

Two booklets put out by Latrobe Steel Co. illustrate and describe type of work company is doing, give some history and plans for future. Firm's various products are detailed and production flow diagram is given. Operations followed in making products are also outlined. For copies, write David Hughes, Latrobe Steel Co., Latrobe, Pa.

Aluminum alloy casting data book presenting government and civilian specifications has been released by the U. S. Reduction Co. Comparison charts and chemical composition percentage listings are provided for die casting permanent mold and sand casting alloys. Other sections list permanent mold and sand alloy heat treatments and annealing and stress relieving aluminum castings. Also listed are deoxidizing aluminum for use in steel manufacturing, aluminum alloy hardeners for zinc base die castings and fluxes. Write R. S. Neufeld, U. S. Reduction Co., East Chicago, Ind.

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- ✔ *Sheets*
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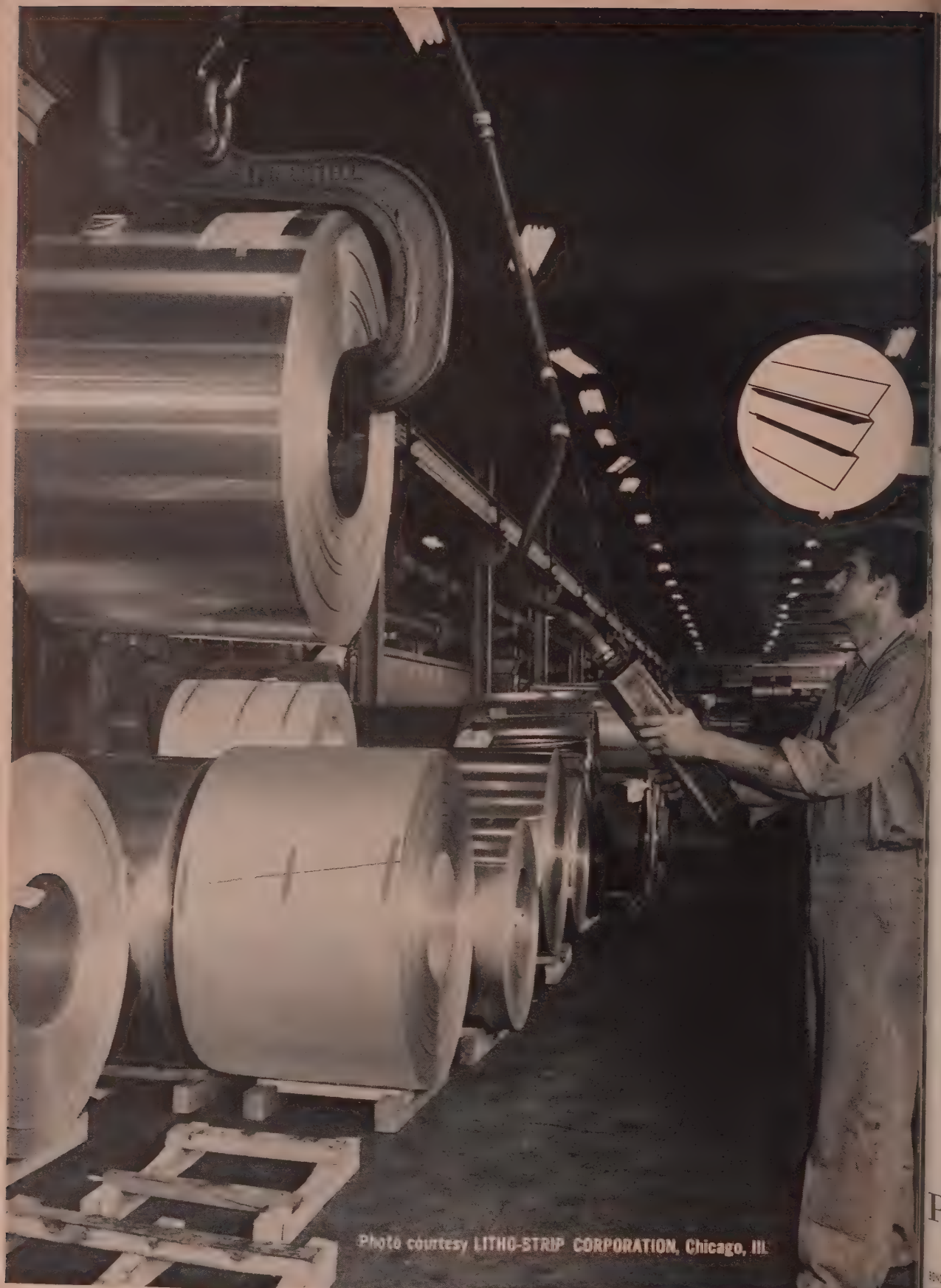
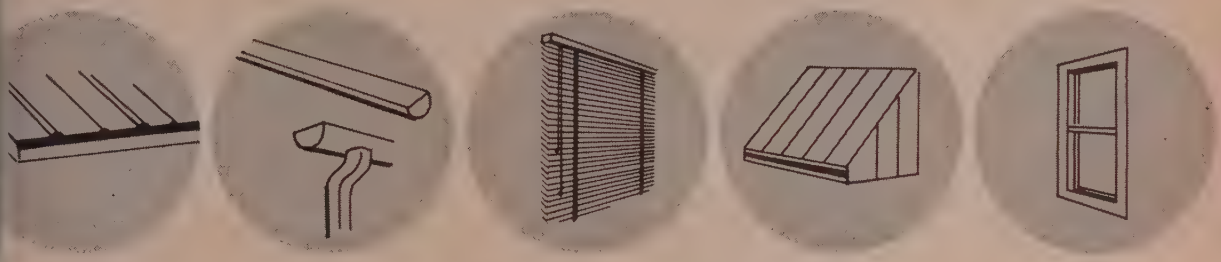


Photo courtesy LITHO-STRIP CORPORATION, Chicago, Ill.

BONDERIZED ALUMINUM

makes your painted products look better longer



Most famous of all surface treatments for metals—BONDERITE—makes painted aluminum look better longer.

Bonderite on aluminum means fine appearance longer, because it controls corrosion and anchors the paint.

Bonderized and painted aluminum is produced on automated strip lines in which the metal is cleaned, Bonderized and painted, then re-coiled ready for use.

Stamped or roll-formed products are made from pre-painted, Bonderized aluminum coil without loss of paint adhesion, even from the most severe deformation. Here's production efficiency and economy at its best—better products at less cost.

Many Applications of Bonderite for Aluminum

There's more than one type of Bonderite for use on aluminum. In wide use is Bonderite as a base for paint, which adds durability and long life to paint finishes on so many aluminum products.

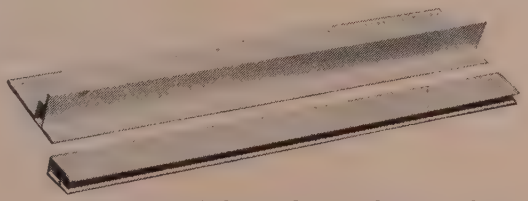
Another Bonderite produces an attractive green coating, used on many architectural products without further finish.

Protection without changing the characteristic color of the metal is provided by another Bonderite.

There is also a Bonderite, formulated for mixed production, which coats aluminum, steel and zinc.

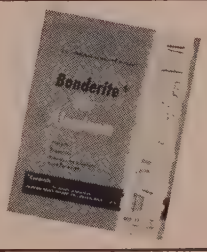
Bonderite for aluminum meets and exceeds the requirements of Government Specification MIL-C-5541.

Well over two hundred plants—large, medium-sized and small—use these great Parker products on their aluminum production. Better investigate for *your* plant, today!



Aluminum window and screen frame sections Bonderized, painted and formed after painting. No breaks in finish anywhere! (Courtesy, Security Co., Detroit, Mich.)

SEND FOR ILLUSTRATED BULLETIN!—*Free bulletin, with more complete information and details, mailed immediately upon request. Ask for Bulletin A6790, "Bonderite for Aluminum."*



Parker Rust Proof Company

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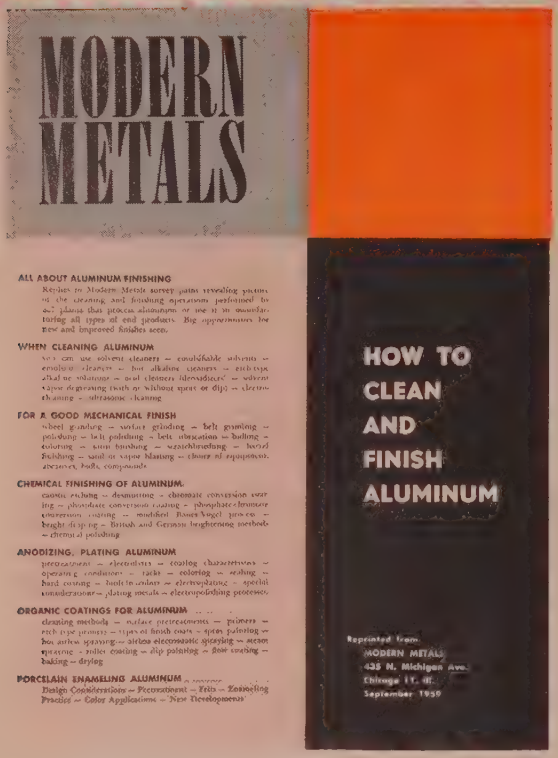
BONDERITE corrosion resistant paint base	BONDERITE and BONDERLUBE aids in cold forming of metals	PARCO COMPOUND rust resistant	PARCO LUBRITE—wear resistant for friction surfaces	TROPICAL—heavy duty maintenance paints since 1883

**Bonderite, Bonderlube, Parco, Parco Lubrite—Reg. U.S. Pat. Off.*

36 pages . . .

all about aluminum finishing



Single copies of this valuable reprint are now available at $1.00; from 6 to 25 copies, 75c each; for quantities over 25, 50c each. To order, simply fill in the form below and mail it, with payment, to . . .

MODERN METALS

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Send me_____copies of the reprint, "How to Clean and Finish Aluminum." Payment is enclosed.

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12-59

New Enterprise

Magnesium and aluminum die casting production of Dow Metal Products Co. has been transferred from Midland to nearby Bay City, Mich. All of Dow's metal casting and fabricating operations are now located there.

Aluminum forgings and screw machine products will be produced by Automatic Machinery Co., division of Tool Engineering Service of Birmingham, Ala., in a plant recently leased from the Port Authority of Panama City, Fla. Operations had been previously carried on in Birmingham, but the need for larger quarters prompted a move.

Aluminum encases an automatic **clothesline reel** which retracts line after use. Unit can be used inside or out, and comes with a plastic line in 20 or 40-foot lengths. Locking ring holds line taut and allows only length needed to be unreeled. Unit is produced by Cordomatic, 17th and Indiana Ave., Philadelphia, 32.

Solid hub type **precision gears** are made in anodized aluminum by U. S. Gear Corp., 81 Bay State Rd., Wakefield, Mass. They come with 0.120, ⅛, 3/16 and ¼-inch bore sizes in standard diametral pitches 48 through 200 and with consecutive tooth selection range from 20 through 120 teeth. Gears are produced to AGMA Precision Class 1 and 2 tolerances.

Aluminum alloy side opening **stringing blocks** designed for straining and sagging ACSR aluminum conductors are made by Dicke Tool Co., 1201 Warren Ave., Downers Grove, Ill. Blocks come in 10-inch size with tension limit of 5000 pounds, and 16-inch size, with 10,000-pound limit.

Heavy-wall square aluminum tubing frames **table and chairs** produced by Afco Aluminum Furniture Co., 7000 N. W. 37th Ave., Miami 47, Fla. Legs are plastic capped while chairs are upholstered with ribbed woven plastic fabric which affords ventilation and resilience.

All-State Welding Alloys Co., 255 Ferris Ave., White Plains, N. Y., manufacturer of **aluminum welding supplies**, has moved into new West Coast facilities at 4954 Firestone Blvd., Los Angeles. The new outlet has welding-wire spooling machines designed for maximum tension control and level layer applications during spooling.

A new line of **spring-nuts** comes in aluminum and other materials in sizes No. 4 through ⅜-inch, tapped class 2B. Manufactured by Jacobson Nut Mfg. Corp., Box 177, Kenilworth, N. J., the nuts are self-locking, one-piece units which eliminate need for lock washers and wrenches.

A. M. Castle & Co., Franklin Park, Ill., one of the nation's largest metal distributors, has acquired land

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AND USING ALUMINUM COILED SHEET?

WHY NOT GET PERSONALIZED SERVICE FROM PEOPLE WHO REALLY APPRECIATE YOUR BUSINESS...

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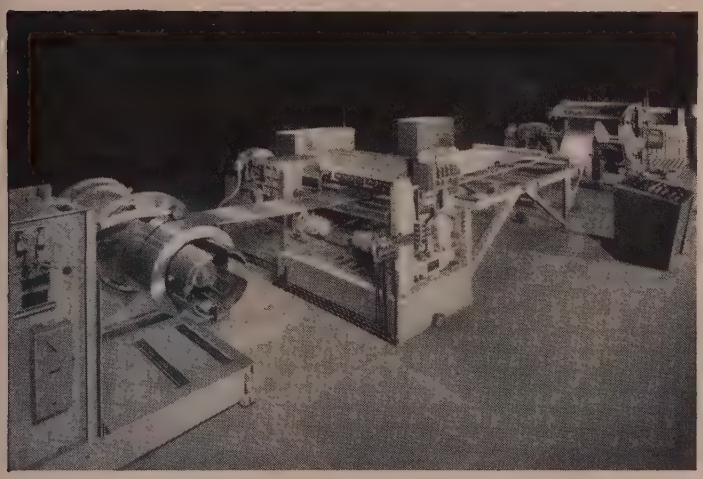
ONE OF AMERICA'S OLDEST AND MOST EXPERIENCED CUSTOM ROLLERS



Overall view of new Voss "coil leveling line" for production of siding quality aluminum up to 48" wide. Modern equipment such as this means better quality aluminum from Sheet Aluminum Corporation.

It's hard to beat the combination of personalized attention from a small, experienced company that possesses some of the biggest and best equipment in the industry. You get top quality aluminum and you'll always be certain that your specifications will be met.

Sheet Aluminum Corporation operates a modern 4-Hi rolling mill . . . a new 48" Voss Leveler and matching units to custom roll aluminum to any thickness from .006" to .102" in coil or sheet . . . widths from 3/8" to 48". A wide range of alloys include 1100, 3003, 5005, 5050, 5052, 5357 and 5457.

On your next order for coil or strip aluminum, get personalized service . . . faster service . . . better service . . . from one of America's most experienced and best equipped custom rollers . . . SHEET ALUMINUM CORPORATION.

Write today for our new Facilities Bulletin.

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Better ALUMINUM Extrusion
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This truck type oven is now in service at Penn Extrusion Corporation, Erie, Pa. Close temperature control is maintained through the use of two gas fired, recirculating air heating systems. Other Carl Mayer design features assure trouble-free, economical operation. Write for Bulletin HT-53.

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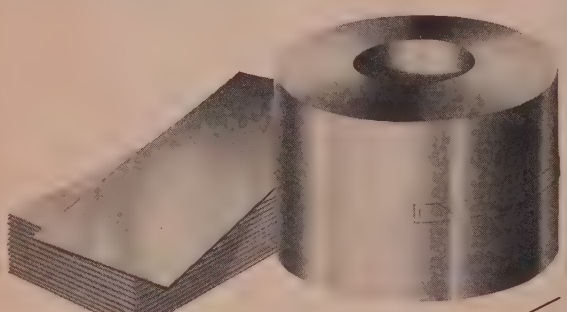
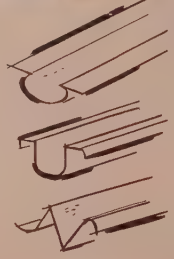
ALUMINUM coils and sheets



IN STOCK . . . coils for Slitting, Flat Sheets for Shearing. Wide range of Alloys and Tempers. Immediate Delivery—COMPLETE WAREHOUSE FACILITIES



GLadstone 5-7000

PSW
PRECISION STEEL WAREHOUSE, INC.
3500 N. WOLF RD. • FRANKLIN PARK, ILL.
(Chicago Suburb)

for the construction of an **Aluminum and Steel Service Center** in Galion, Ohio. Cass Sisler will manage the operation, scheduled for completion by April. In addition to inventories of aluminum and other metal products, complete shearing, sawing and electronic flame-cutting equipment will be installed.

Steam escapes but troublesome grease splatter is stopped by a new **aluminum cooking pan cover** made by Aluminum Filter Co., 626 E. Gutierrez St., Santa Barbara, Calif. The "Fry-Crisp" lid is made of knitted aluminum wire enclosed in a round one-piece aluminum frame. It can also be used with a deep aluminum skillet for corn-popping.

A die cast aluminum adjustable **torque handle,** with hardened-steel insert cast in, is being manufactured by Vlier Engineering Corp., 8900 Santa Monica Blvd., Los Angeles 46. The handle is used to control clamping pressure on assemblies and machinery, thus eliminating machining necessary to adapt ordinary thumbscrews to existing set-ups. End pressure is adjustable from 15 to 200 pounds, and tapped hole comes in 5/16-18, ⅜-16 and ½-13 sizes.

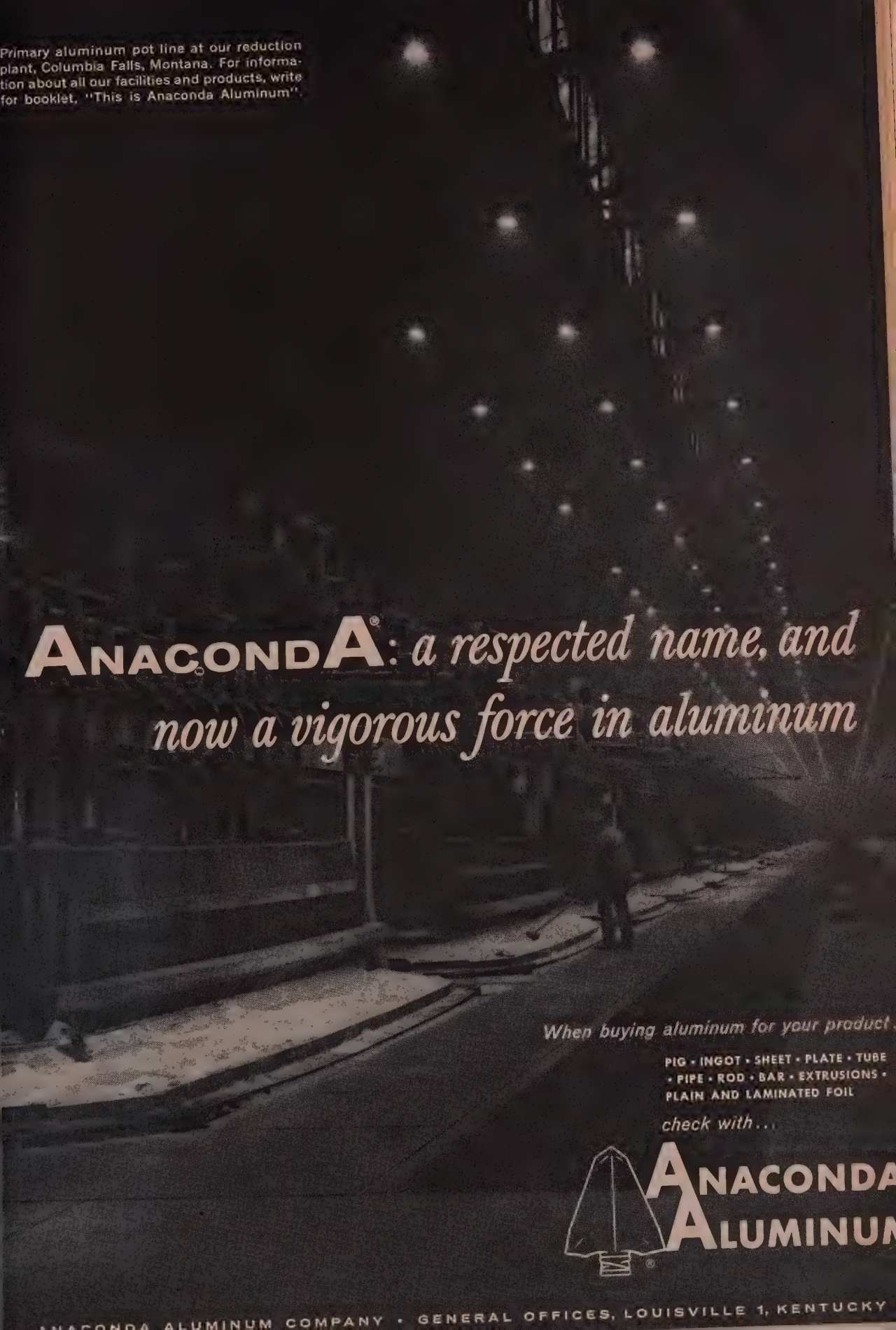
Cast aluminum furniture is offered in a wide assortment by Avondale Foundry, 2500 27th Avenue, N., Birmingham, Ala. Array includes decorator three-panel screen available in five colors, and grape, rose and lyre design lawn sets.

Champion Storm Window Corp., 1712 Jericho Turnpike, Hyde Park, N. Y., manufacturers of aluminum **storm windows and doors,** has begun operations in a branch plant in Gordonsville, Va.

The **ground cushion vehicle** being developed for the armed forces by National Research Associates, College Park, Md., is constructed of aluminum, though the body shell and internal air ducts are of glass fiber. Unit is powered by a 40 h.p. piston engine at both ends, each driving two shrouded, six-bladed, 42-inch diameter propeller fans. A stick controls forward, backward and sideward movement. Marines are now evaluating GEM-1 (Ground Effects Machine), which is 14 feet, 7 inches long, operates at 9 to 15 inches altitude, and is designed to travel at 38 to 55 mph.

Tower brand **aluminum holloware,** a well-known British product, will be manufactured and sold by a new company, Tower Aluminium Nigeria, Ltd., located in Lagos, the federal capital. The new company, which will begin production in May, will serve the domestic market of Nigeria, and will later export products to other parts of Africa. The firm is financed, in addition to Nigerian capital, by Aluminium Ltd., Canada, and Midland Metal Spinning Co., Wolverhampton, England, which has controlling interest.

Lake Park Metal Stamping, Inc., 1122 Velma Court, Youngstown, Ohio, plans to introduce additions to its line of **door hardware** in the near future. The firm is now producing 3-inch aluminum butt hinges, con-



Primary aluminum pot line at our reduction plant, Columbia Falls, Montana. For information about all our facilities and products, write for booklet, "This is Anaconda Aluminum".

ANACONDA®: *a respected name, and now a vigorous force in aluminum*

When buying aluminum for your product

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For *ANODIZING*

Painstaking effort by Kawneer's anodizing specialists promises flawless, clear coatings that meet the most exacting specifications for manufactured products — and makes Kawneer a dependable source for anodizing work. Our tanks are 25 feet long. We welcome trial orders.

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for *EXTRUSIONS*

A NEW 1250-TON EXTRUSION PRESS has been added to our original 2200-ton unit, placing us in a position to serve more users of aluminum extrusions. When you consider extrusions, consider Kawneer.

KAWNEER CO. Mill Products Division

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For Better Finish, Longer Die Life, Ease of Application In Your Extrusion Process Use Graphite Dispersions

GRAPHITE PRODUCTS CORPORATION manufactures metal working dispersions for the newer metals and alloys. Each formulation has been developed for a specific application. Factory testing has shown that some of our compounds can be used successfully in many different operations. Bulletin 581 briefly describes some of these products and their uses.

GRAPHITE PRODUCTS CORPORATION welcomes the opportunity to develop formulations to meet your particular needs. A qualified staff consisting of application engineers as well as research specialists is as near as your telephone. For immediate service telephone TUxedo 9-4221 (Warren, Ohio).

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High Temperature Lubrication

Parting

Die Lubrication

Drawing

Descriptive literature and working samples on request.

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BROOKFIELD, OHIO

tinuous hinges for either Z-bar or expander doors, and closers, latches, locks, and safety chains for combination storm doors.

Wolverine Tube, Div'n of Calumet & Hecla, Inc., Allen Park, Mich., has opened new **district sales offices** in Los Angeles and San Francisco. John A. Marshall is San Francisco district sales manager, with J. J. Boyett working as sales representative. H. F. Powell manages the Los Angeles area, assisted by sales representatives W. C. Glass and C. W. Barker.

Pass window for use between kitchen and dining room of mass feeding operations has an **aluminum shutter** that rolls up out of sight into a stainless steel enclosure. Unit can be furnished for any wall thickness by Cornell Iron Works, Inc., Long Island City 6, N. Y.

Wrought aluminum **outdoor group** of round table and four chairs is offered by Scroll Inc., 800 N. W. 166th St., North Miami, Fla. Lightweight set was designed by Herbert Saiger. Chair seat and back are of vinyl strapping.

A unique flashing consisting of a sheet of soft-drawn aluminum, coated on both sides with elastic, bituminous compound composed of high-grade asphalts, has been used to weatherproof two recently constructed New York buildings. Rubberseal Aluminum is produced by Mitchell Rand Mfg. Corp., 51 Murray St., New York 7, N. Y. The weatherproofing has mild temper and flexibility which allows workmen to shape it to irregular objects by hand, and to make right-angle bends without using a brake or other forming equipment.

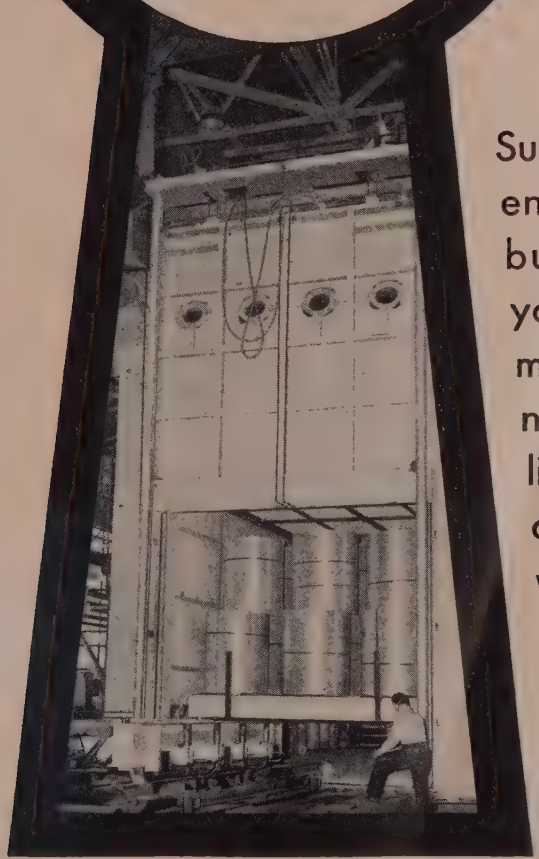
Magnesium-thorium mill products of the Dow Metal Products Co. Division, Midland, Mich., are being stocked by the following distributors: A. R. Purdy Co., Inc., Page Ave. and Orient Way, Lyndhurst, N. J.; and Reliance Magnesium Co., 2068 E. 37th St., Los Angeles 58, Calif. Both firms will stock standard size HK31A-H24 sheet and plate.

Impact-Extrusion Co., Inc., Turbotville, Pa., is mass producing closed die **impact-extruded forgings.** The firm says its nonferrous forgings have a finished surface equal to that of machined parts, plus full strength. The process makes items held to consistently close tolerances, making it able to produce intricate parts impractical with other methods.

A new type **ironing-board cover,** called Aluminate, consists of a laminate of aluminum foil and acetate plastic sheet. Trio Mills Mfg. Corp., 829 E. 134th St., New York, is producing 100,000 such covers a month. The laminate is covered with a conventional drill fabric. Heat is reflected and spread by the aluminum, thus requiring less dampening of clothes.

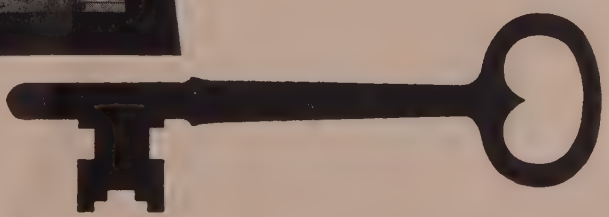
Lifeguard Alarm, a **small siren system** powered by flashlight batteries, can be heard 1/5 mile away. Hung near the ceiling, and requiring no wiring, it takes only 135 degrees of heat to trip. The aluminum safeguard is manufactured by Arandell Products Co., 3915 Powelton Ave., Philadelphia.

YOUR FURNACE



SUNBEAM WILL BUILD YOUR "TURN-KEY" FURNACE EQUIPMENT FROM DESIGN TO INSTALLATION

Sunbeam will handle the entire job of designing, building and installing your next furnace equipment. And whether you need an entire furnace line... or a single piece of equipment . . . *it's wise to get a quote from SUNBEAM.*



Sunbeam

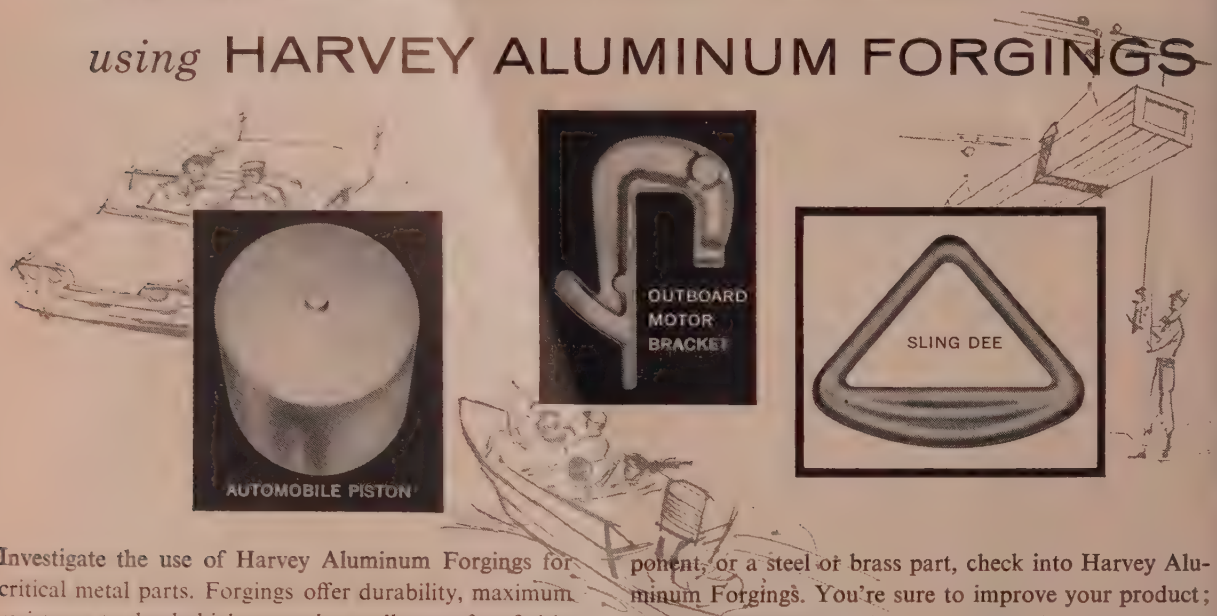
The Best Industrial Furnaces Made

SUNBEAM EQUIPMENT CORPORATION
196 Mercer St., Meadville, Penna.

whatever you make

you can improve your product

using HARVEY ALUMINUM FORGINGS



Investigate the use of Harvey Aluminum Forgings for critical metal parts. Forgings offer durability, maximum resistance to shock, high strength, excellent surface finish, and other properties unobtainable in cast form. And in aluminum, you benefit from a high strength-to-weight ratio, attractive appearance, maintenance freedom, easy machinability, broad design flexibility, plus other inherent advantages.

The next time you have a problem with a cast component, or a steel or brass part, check into Harvey Aluminum Forgings. You're sure to improve your product; you'll undoubtedly gain the competitive edge you're looking for, and there's a good chance of reducing your manufacturing costs. For technical or design assistance, call a Harvey forging specialist listed under "Aluminum" in your directory, or contact the general offices in Torrance, California. This advisory service is available without obligation . . . that's their job.

A major independent producer of quality aluminum in all alloys and sizes: Pig, ingot, billet, rod and bar, pipe, tube, hollow sections, press forgings, forging stock, hand forgings, impact extrusions, electrical bus bar, structurals, special shapes, light and heavy press extrusions, screw machine and other aluminum products. Similar products in titanium, zirconium, and steel. HARVEY ALUMINUM SALES, INC., Torrance, California

HARVEY Aluminum

1960 AUTOS PROMISE RECORD ALUMINUM CONSUMPTION

Three new compact cars and a rising U. S. economy give reason this year to the auto industry's perennial optimism. Aluminum people can be a little casual about record sales to this market in '60; aluminum components of the type used in the new small cars promise even greater volume in the future.

By H. K. Darby, Associate Editor

A TRIO of new compact cars are hogging the spotlight as the 1960 automotive year gets underway. They are helping set the stage for record auto sales in a model year that coincides with a rising U. S. economy. Car-hungry Americans who couldn't indulge themselves during the past two years are ready to buy now.

Chrysler's Valiant, Ford's Falcon and General Motors' Corvair caught the public's fancy immediately upon introduction, demonstrating their saleability in October and November. As the effects of the steel strike wear off, they are expected to help raise total sales to 7 million cars or more in the next 10 months, a period toward which the car makers look forward with delight.

Regarding *its* prospects in the automotive field, the aluminum industry has even greater cause for optimism. Because the average weight of aluminum per car has increased again, the aluminum industry can bet on a sizable gain in sales to this market, even if the auto makers prove to have been overgenerous in their estimate.

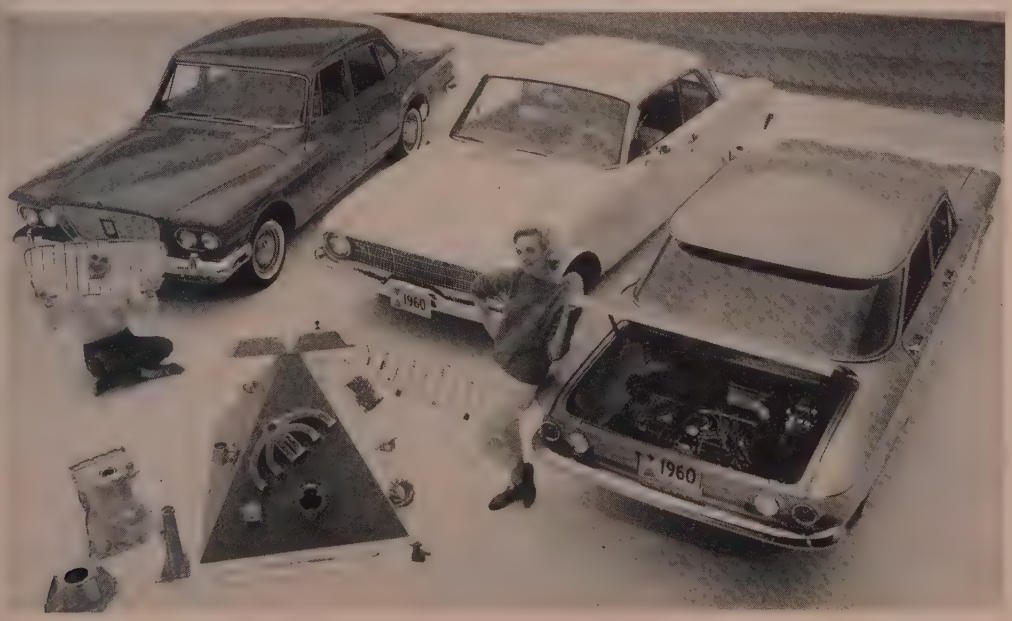
Whereas the average weight of finished aluminum components in 1959 was 49.6 pounds per car, the figure for the 1960 model year is reckoned at 56.2 pounds per car by Kaiser Aluminum & Chemical Corp. This would mean that in a 7-million car year total aluminum consumption would exceed 393,000,000 pounds.

"Aluminum's steady penetration of the automotive market is apparent when you consider that the per car average five years ago was about 25 pounds, and that a decade ago, 1950 model cars averaged 12 to 13 pounds," commented V. E. Flaherty, Kaiser's automotive industry manager.

As of this writing, possible resumption of the steel strike for a prolonged period could explode dreams of record or near-record auto sales and nullify temporarily aluminum's anticipated gains. However, there is much to indicate that settlements will be reached before expiration of the 80-day "cooling off period." Already there are convincing signs that the steel "pipeline" to the auto industry is being brought to normal levels.

The big story in automotive circles is the Corvair engine. An American-built aluminum engine (and rear-mounted besides) constitutes a revolutionary development, even though the light metal had been used for American car engines well over 30 years ago. Aluminum blocks are almost commonplace in Europe today. The difference is that Corvair happens to be a General Motors development.

Production of some 300,000 Corvairs in 1960 was forecast by E. N. Cole, general manager of the Chevrolet Division and guiding spirit behind development of the jaunty little car and its unique power plant. According to Alcoa, weight of the Corvair's engine "is estimated to be less than 250 pounds." Assuming that the raw aluminum castings weigh around 90 pounds (this is guesswork, based on an over-all reported weight of 104.7 pounds of aluminum parts in the car), these components



■ *America's three newest cars, from the left, Valiant, Falcon and Corvair, average 73 pounds of aluminum each, 17 pounds more than the average of all 1960 autos. Chevrolet's Corvair is powered by the first mass-produced aluminum engine in America. Other important aluminum parts are shown.*

alone would consume 27 million pounds.

Cole's prediction, incidentally, could be on the conservative side, considering the 57,000 Corvairs produced in the first two months of its model year, when steel was short. But the implications of Corvair's use of aluminum is what excites the aluminum producers. If Corvairs can have aluminum engines, so can other cars. In fact, three other GM models with aluminum engines are expected to make their debuts in 1961.

It's Significant Because . . .

From the aluminum industry viewpoint, nothing but good can result from this entirely new class of American cars.

All told, the Corvair has 60 different aluminum chassis and body parts, only 12 of which are identified as decorative details. Forms of aluminum used include rod, bar, wire, permanent mold, die and sand castings, sheet, plate, tube and even foil. But the engine is the important thing — more because it demonstrates the opportunities inherent in "hot metal" arrangements (thus far practiced only by Reynolds Metals Co.) than for the tonnage involved.

Operations at the Corvair engine foundry at Massena, N. Y. are reported to be unique. As of now, the castings are produced by a low-pressure injection process licensed to Chevrolet by Karl Schmidt, Hamburg, Germany, who designed similar components for the Porsche. [Modern Metals will publish a detailed account of this activity in the near future.]

The Big Three's compact cars are described by J. Donald Shircliff, Reynolds' regional manager in Detroit, as incorporating most of the major aluminum applications developed in the last 10 years, while "bringing with them new usages" that serve as guideposts for the whole industry. He cited the following applications in each of the cars which would doubtless be adopted by the automobile industry as a whole:

The Corvair camshaft runs directly on a bearing machined into the cast aluminum crankcase, eliminating the need for bearing inserts.

The Falcon air-cooled transmission has an integrated transmission bell housing and case; the heat dissipating properties of aluminum in this design eliminated need for a transmission oil cooler.

The Valiant is equipped with a greatly simplified generator, called an alternator. Extensive use of aluminum has reduced the weight of this Chrysler-designed unit to about 12 pounds, less than 60% of the weight of a conventional generator. Chrysler reports the unit's ability to generate charging current at idling speeds, an advantage that has caused the alternator to be scheduled into all Chrysler cars next year.

There are other noteworthy aluminum features in the compact cars, but auto industry advances involving the metal extend to the heavier cars, too.

"There has been a tendency to incorporate more aluminum in the Mercury, Edsel and Lincoln, and this tendency continues in the 1960 models," a Ford Motor Co. spokesman reported. Actually, the Thunderbird is the only Ford veteran to show an increase in the Kaiser tally, and Edsel is on the way out. Falcon is reported to have 49.6 pounds of aluminum parts.

■ ***Aluminum grille of Chrysler's Valiant typifies aluminum's growing popularity in auto trim parts. Young lady is pointing to aluminum ingot representing tonnage increase in aluminum trim from 1957 through '59, as estimated by Alcoa.***

Chrysler Corp. cars again lead the industry with an average of 69.9 pounds per car, 12.9% over the group's '59 average. Plymouth leads all makes with the largest increase, 31.3%, according to Kaiser.

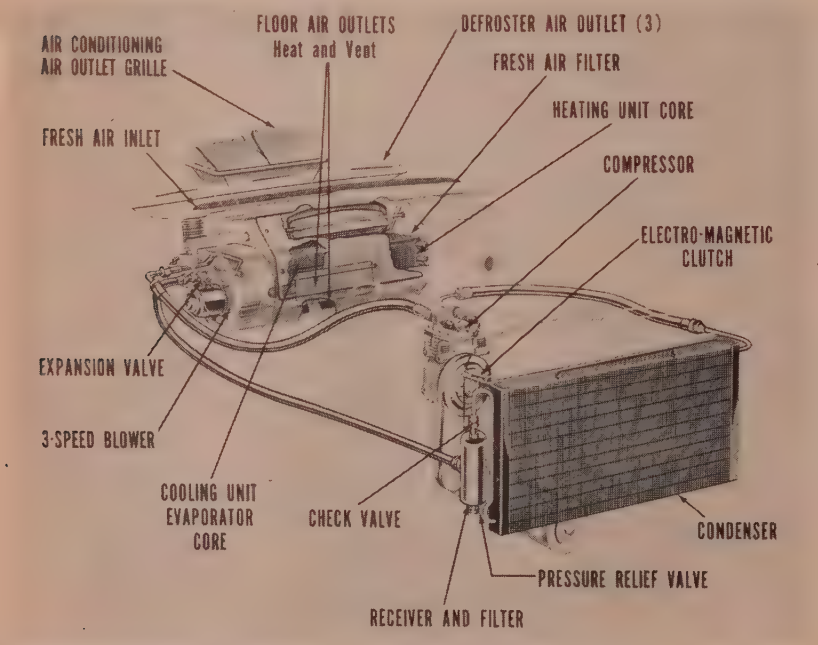
American Motors Corp., initiators of the compact car idea (they coined the term for the new size betwen small and standard cars), remains on top in the sales contest in this class. Having produced 374,240 Ramblers last year, the company has set a goal of 500,000 for the '60 model year.

"In the entire Rambler line, including the Rambler Six and Rebel V-8, American and Ambassador V-8, we use window frames made of aluminum," an American Motors man said. "The Ambassador uses aluminum side trim on the custom model; aluminum headlight bezels are employed on the Rambler Six and Rebel V-8 and Ambassador V-8. The American has an aluminum grille. The escutcheons on all models are aluminum. All trim parts are anodized."

Use of aluminum in the compressor of American Motors' All-Season air-conditioning system has whittled 19 pounds off its total weight. The compressor weighs only 15½ pounds. This type of component is optional, however, and isn't likely to consume a great deal of aluminum. Such is the case with many parts in the Pontiac. Out of 48 parts in the 1960 Pontiac made entirely or partly of aluminum, 22 are optional. The aluminum front wheel, hub and brake drum assembly is an example.

Adoption of aluminum wheels has been slow. Buick was first to use them

(*Continued on page* 42)



■ ***Weight of compact All-Season air conditioning system for American Motors' Rambler was reduced 19 pounds by the use of a new aluminum compressor.***

LINDBERG FISHER

This nameplate is on all the equipment anyone needs for melting and holding aluminum

Heat and aluminum have been Lindberg's babies for many years. If your product requires the application of heat to aluminum anywhere along the line, we can help you do the job. Lindberg-Fisher furnaces cover every requirement of "heat for aluminum" and embody the latest developments in the field. Many new design and engineering features make Lindberg-Fisher melting and holding furnaces, and accessories, the most modern equipment available to industry.

With Lindberg-Fisher furnaces too, you get the expert technical skills of Lindberg Engineering Company's staff of engineers, metallurgists, technicians, widely experienced in all phases of aluminum melting, casting and treating. Because Lindberg builds all kinds of melting equipment, gas—oil—electric (resistance, 60 cycle induction, arc, or high frequency) . . . we can intelligently and objectively recommend the proper type of furnace to suit your particular conditions and needs.

We can fit the latest melting and holding equipment into your production line efficiently and economically—helping you to manufacture your product to closer specifications, and at a lower cost. Consult your local Lindberg representative. You'll find him listed in the local classified telephone directories in major industrial areas.

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Also factories in: Argentina, Australia, England, France, Germany, Italy, Japan, Scotland, South Africa, Spain and Switzerland.

On the following two pages we've illustrated and described the Lindberg-Fisher equipment that covers all your "heat for aluminum" needs. Will you please turn the page?

LINDBERG heat for industry

Starting with alloyed ingot or molten metal delivery from the reduction cells, aluminum can be processed in a wide selection of furnaces.

In Melting and Holding Furnaces

As shown in the flow diagram molten aluminum is delivered to either large capacity fuel fired reverberatory furnaces, or tilting two chamber induction furnaces for storage at suitable temperature . . . or alloyed ingot is melted and stored in similar furnaces . . . to provide an adequate supply of molten aluminum for the casting station area furnaces.

In Casting Station Furnaces

Molten metal received from the large storage or breakdown furnace described above or from smaller melting furnaces—again either fuel fired or electric, is received at the casting area, maintained at the correct temperature and processed into desired castings. Most of the holding furnaces illustrated can also be used for melting.

Many of the casting station furnaces shown can be equipped with the Lindberg-Fisher Autoladle for automatic ladling or hand ladling.

Hot Metal Delivery

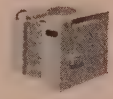
Ingot

Fuel fired reverberatory, melting or holding. Charging well optional.

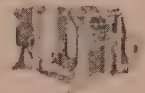
60 cycle two chamber induction, tilting; melting or holding.

Fuel fired, double reverberatory melting and holding. Especially suitable for alloying. Charging well optional.

60 cycle, two chamber induction, tilting; melting and holding.



60 cycle induction coreless, tilting, especially for melting chips.



Fuel fired, crucible or pot, tilting, melting.

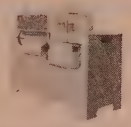
Electric resistance, "radiant muffle," Dry-Hearth, melting and holding, nitrogen atmosphere, especially for insert scrap.

High frequency induction, tilting, melting.

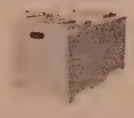
Autoladle for automatic ladling, four standard sizes available, up to 100 lbs.

HYNI generator, low cost, high purity dry nitrogen.

Fuel fired reverberatory, holding or melting.

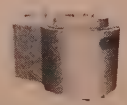


Electric resistance, "radiant dome," reverberatory, holding.



60 cycle, two chamber induction, holding or melting, stationary.

Fuel fired crucible or pot, holding or melting, stationary.



Electric resistance, crucible or pot, holding or melting, stationary.

Fuel fired, Dry-Hearth, two chamber, holding and melting.

WHEREVER ALUMINUM NEEDS HEAT, LINDBERG

A unique innovation is the

A unique innovation is the Lindberg HYNI Generator... which supplies dry, high purity nitrogen economically, as a protective atmosphere for both melting and holding applications.

In Remelting Furnaces

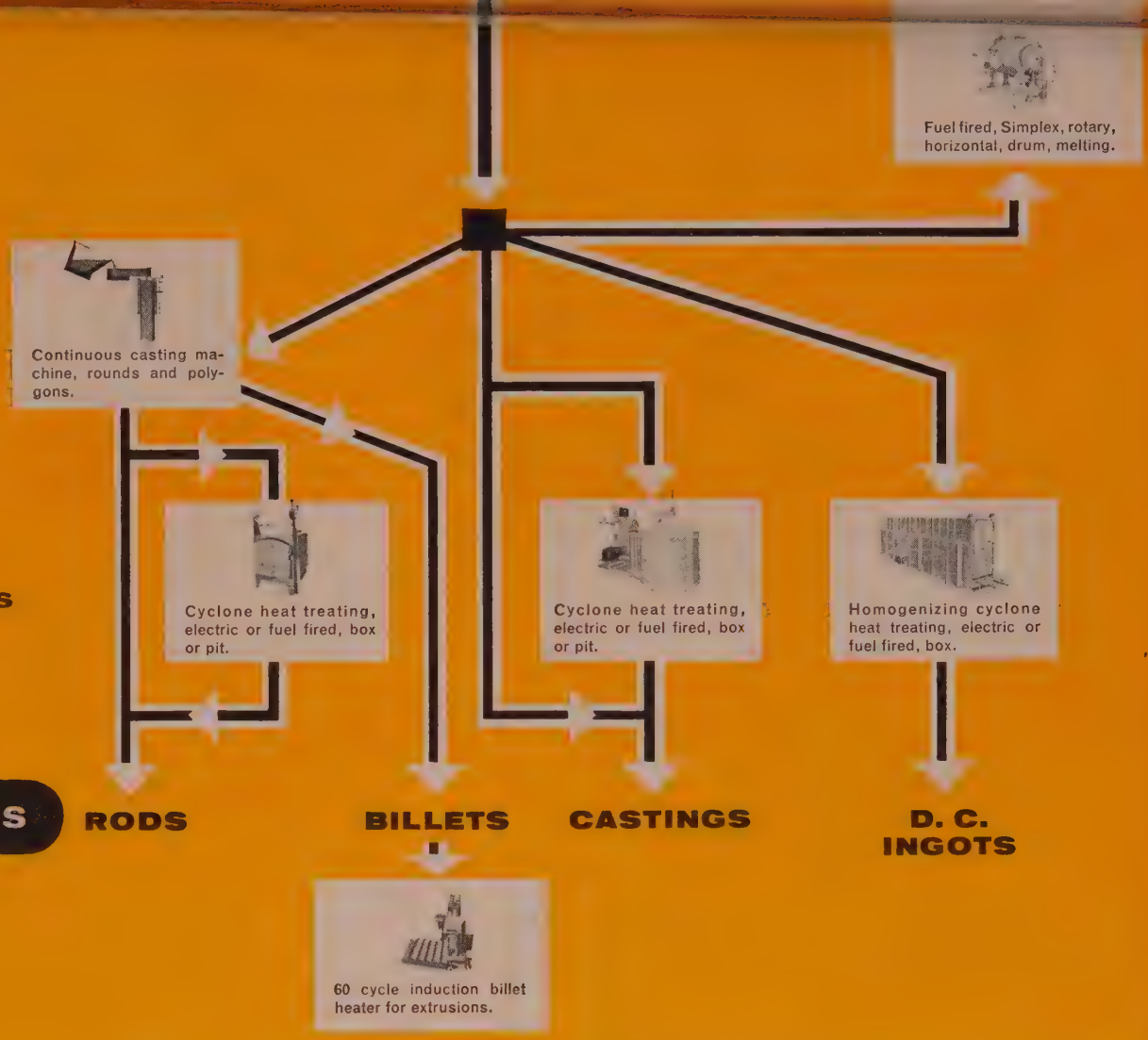
As the castings move out of the casting area for trimming, machining and finishing, the gates, risers, sprues, chips and scrap castings, etc., are returned to a remelt operation in one of the furnaces shown on the far right. These furnaces can be used for ingot meltings as well as for remelt operation.

In Heat Treating Furnaces

From the trimming and sorting station some castings are ready for direct use, others require suitable heat treatment as shown.

TO THE FINAL PRODUCTS

Lindberg can provide ANY furnace for your needs.


Fuel fired, Simplex, rotary, horizontal, drum, melting.
Continuous casting machine, rounds and polygons.
Cyclone heat treating, electric or fuel fired, box or pit.
Cyclone heat treating, electric or fuel fired, box or pit.
Homogenizing cyclone heat treating, electric or fuel fired, box.
RODS
BILLETS
CASTINGS
D. C. INGOTS
60 cycle induction billet heater for extrusions.

LINDBERG heat for industry

FISHER EQUIPMENT WILL APPLY IT MOST EFFICIENTLY

■ *Middle muffler may solve problem of replacing mufflers on an average of less than every two years. Designed to outlast today's and tomorrow's cars, new cast aluminum muffler is expected to reach market before year's end. L. W. Wickson (left), president of Centr-O-Cast & Engineering Co., Detroit, and J. D. Shircliff, Reynolds' automotive sales manager, are comparing three road-tested mufflers.*

—in 1958 as standard equipment on all models. Pontiac installed them on various models destined for hard service—police cars, cabs, etc.

Made with a cast iron friction liner bonded to the aluminum by the Al-Fin process developed by Fairchild Engine & Airplane Corp., the new wheels all but eliminate "brake fade" under the most severe conditions. Aluminum's heat dissipating quality keeps braking temperatures at least 100° F. lower than does conventional cast iron drums.

Forged wheels are made by the Kelsey-Hayes Co., Detroit, based on pioneering developments of Kaiser Aluminum.

Each aluminum wheel reduces unsprung weight by two pounds, compared with a combination steel wheel, hub and cast iron drum. The separate steel rim which takes the tire is attached to the integral aluminum design by a scalloped spider to a 9⅞-inch bolt circle on the outside diameter of the wheel drum.

A Muffler That Lasts

The move to aluminized steel mufflers and tail pipes to lengthen their life gained momentum this year (Chrysler cars, Mercury) and the all-aluminum muffler will probably be used on some of the 1961 cars. Centr-O-Cast Engineering Co. and Reynolds Metals Co. collaborated in developing this muffler which will weigh 40% less than conventional steel units, according to L. W. Wickson, president of Centr-O-Cast.

Steel mufflers are vulnerable internally as well as externally. From the outside they are attacked by moisture and road materials; inside by corrosive vapors in exhaust gases. The aluminum muffler wards off internal corrosion by minimizing condensation (fast warm-up when the engine is started) and by controlled heat distribution achieved by variations in wall thickness. Producing these varying wall thicknesses is economically possible only in cast aluminum, the manufacturer said.

Aluminum's ability to transfer heat quickly provides the same advantage in evaporating condensation by uniform cooling, even after the car is stopped, and is further aided by the finned design which runs the length of the muffler. These fins also shield the unit from serious damage from loose stones.

Road and test track performance trials showed that even at sustained speeds of 100 mph and more, maximum heat recorded was at least 300° less than that which could affect the performance of the cast aluminum muffler.

Dennis A. Nankivell, Reynolds' muffler project manager, said that the Centr-O-Cast muffler gives "unprecedented freedom" to the designer who often has been forced to design as many as 30 different mufflers to meet the varying requirements of a single line of new cars. Because the aluminum muffler is cast it can be formed to meet any anticipated type of frame and body construction or configuration, he explained.

"In conventional types," Nankivell pointed out, "this freedom is curtailed by the limitations of assembled mufflers, which have required that as many as six small mufflers be linked in different locations to meet underbody clearance requirements."

Other advantages cited by Wickson include freedom for inspection because the two halves of the aluminum muffler can be unbolted in minutes; easy repair of external damage caused by accident where normally a whole new muffler would have to be installed; and an increase in horsepower resulting from more efficient muffling.

The current muffler mortality rate is high enough to make the new aluminum unit a desirable replacement item. On this basis alone, Reynolds figures it would add half a billion pounds to the aluminum now consumed by autos.

Foil Coils for Horns

The new model year also marked a breakthrough for foil usage in auto horns. Sparton Automotive Division of Sparton Corp., Jackson, Mich., has switched from copper and aluminum magnet wire coils to interleaved aluminum strip conductor coil units in production of more than a million horns for 1960 cars.

"Aluminum foil offers better heat transfer and dissipation, hence less danger of burnout, all in less space," said

■ *Automobile horn produced by Sparton Corp. uses Reynolds aluminum foil strip conductor coil (bottom) to eliminate 12 bulky parts from old style, copper wire coil horn. The application, first 100% use by any manufacturer, is major breakthrough of Reynolds Metals Co. efforts to familiarize equipment firms with advantages of strip conductor.*

growing! growing! growing!

TO BETTER SERVE YOUR NEEDS

Quaker State Metals Company has just added 45,000 square feet of production space to give you faster service, more individualized attention, better products.

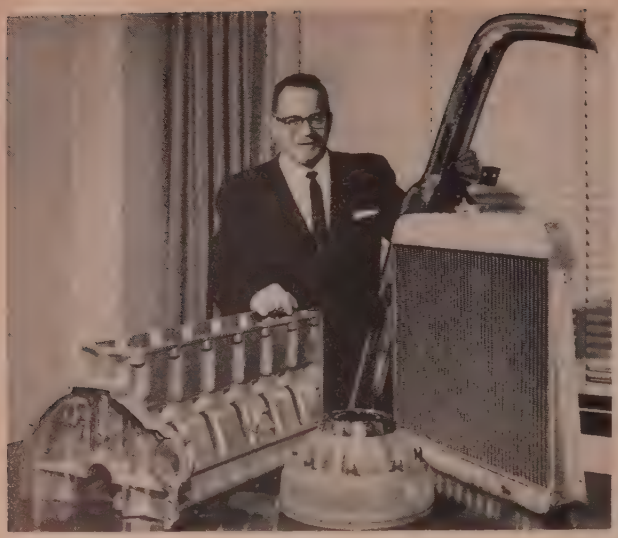
The QSM story is one of growth! Growth to serve our customers better. Since 1957, the company has quadrupled its production space. The newest equipment and machines have been added, and the latest production techniques introduced to control the quality of QSM aluminum—from casting to finished coil and sheet.

To you, this growth means that QSM can give you faster service, more individualized attention, and better products. Want proof? Ask anyone on our growing list of satisfied customers!

QUAKER STATE METALS CO. • LANCASTER, PA.

A Division of HOWE SOUND COMPANY

Mill Producers of Aluminum Sheet and Coil



■ *Aluminum engine block, integral wheel and brake drum, bumper, and radiator displayed here by Robert G. Stanwood, Kaiser Aluminum & Chemical Corp.'s manager of automotive business development, are major automotive applications sought by domestic producers in intensive research and development programs. Together, four items represent a conversion potential of approximately 220 pounds per car.*

Dr. Weichien Chow, chief development engineer at Sparton. "In addition, we were able to eliminate 12 parts from our old model horn for a compact, more efficient unit."

Aluminum foil is more economical than copper wire and offers the advantage of unlimited choice of conductor area, he added. Paper interleaving of the strip cuts insulation costs while providing higher dielectric strength. Costly impregnating and baking of wire coils are eliminated, and electrical connections are greatly simplified.

The new coil represents a coup for Reynolds Metals Co. who have been working on the development in their laboratories over the past six years in cooperation with leading electrical manufacturers.

"The concept of interleaved and anodized aluminum strip conductor has already been applied to many electrical components," said J. C. Warford, the company's electrical equipment market manager. "However, the adoption of strip conductor by Sparton is the first 100% customer acceptance ever attained by an aluminum producer."

Winding equipment used for the new horn coil was developed by Reynolds at its Richmond, Va., coil winding facility.

Slight Gain in Trim

Aluminum trim in the 1960 cars averages about ten pounds per car, according to Robert E. Conlee, an Alcoa automotive development engineer, who told a meeting of the American Society of Body Engineers last Fall that 150,000,000 pounds of aluminum alloy have been consumed for trim in the past four years. About 70% of the aluminum sold for trim had exterior application, he said.

The ten-pound average jibes with Kaiser's estimate for 1960 usage and represents a slight gain over Kaiser's estimate of nine pounds used in '59 models. It suggests that aluminum's penetration of body trim applications is in for a leveling-off period until aluminum bumpers gain general acceptance by the auto makers. This, Conlee hints, might have its beginning next year.

Principal Uses Include . . .

Using the top selling models of the "low priced three" as its yardstick, Kaiser figures that the principal aluminum trim components include grille and grille mouldings, headlamp bezels, bumper filler panels, tail lamp bezels, lower back panel, applique and mouldings, instrument panel applique, interior mouldings (roof bows, seat skirts and backs, garnish mouldings, etc.), name plates, scuff plates and quarter panel appliques.

Using the same models for a composite list of principal functional aluminum parts, Kaiser lists pistons, generator and starter end plates, automatic transmission housing and extension, converter housing (various internal components), power brake and steering components, brake cylinder pistons, windshield wiper motor assembly, carburetors, distributors, oil pumps, rocker arm supports, shock absorber assemblies.

In Optional Equipment . . .

Aluminum is proving to be highly desirable for many optional features in car interiors. In some models, for example, glove compartment doors which open down to serve as picnic snack tables — even to round depressions to hold cups or tumblers upright.

A handy refrigerator which fits under car dashboards is another development. Called "Strata-Freeze," and made by Pol-Air, Inc., Morgan City, La., the unit can be installed quickly and is fully insulated to maintain near-freezing temperatures in all driving conditions. The tiny refrigerator is said to be economical to operate because it uses vapor in the car's fuel line as a refrigerant. Its motor is the car engine.

Inner and outer walls of Strata-Freeze, plus universal mounting brackets, are made of aluminum. It is made in several colors to complement any car interior.

Another optional item available for all Chrysler cars is an aluminum screen which is fitted into the tail-gate window of the station wagon lines. It furnishes insect protection when the tailgate window is rolled down. A wider-meshed, heavier screen is also made as a safety device for kids.

(*Continued on page 46*)

■ *Strata-Freeze made by Pol-Air Inc., Morgan City, La., is a refrigerator which mounts under dashboard. Aluminum is used in mounting brackets and inner and outer shells. Near-freezing temperatures can be maintained under all driving conditions.*

KAISER ALUMINUM

ALUMINEWS

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Immediate Delivery on Super Purity Aluminum Ingot

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Essential to the petroleum industry, where it is employed in catalysts to produce high octane gasoline, new super purity aluminum is in demand by a growing number of other fields as well.

As capacitor foil for electronics, radio and TV equipment, super purity aluminum contributes toward more compact, efficient and longer lived units. It is especially desirable as decorative trim for automobiles and appliances because of its corrosion resistance, high reflectivity and ability to take exceptionally bright and colorful finishes. It is also used extensively in the costume jewelry industry.

Now available for immediate delivery in ingot form, new super purity Kaiser Aluminum ingots are produced in some of the world's largest reduction cells at Mead.

Here, the most advanced methods of painstaking quality control are employed to assure purity. Operating conditions are carefully regulated. Special graphite tools are used to protect against impurities. And every cast must pass a rigid quantometer test before it's ok'd for shipment.

Kaiser Aluminum packages high purity ingot to customer specifications in polyethylene wrap to further protect against dust and impurities. For complete information, send in the coupon below.

New Bright Aluminum Sheet for Decorative Trim

With the addition of Kaiser Aluminum's recently built 2-Hi bright strip mill at Ravenswood, an expanded source for bright sheet becomes available to the automotive, architectural, appliance, lighting equipment and other industries.

Bright sheet rolls off mill at Ravenswood, W. Va.

The new mill is the latest addition to Kaiser Aluminum's extensive rolling facilities at its centrally-located Ravenswood works. Capable of taking one of the lightest passes in the industry, the mill produces bright aluminum sheets in widths up to 36 inches and in gauges one-sixteenth of an inch or less.

The eye-appealing brilliance and physical properties of Kaiser Aluminum's new bright sheet promise to make an important contribution to manufacturing plans in many fields.

For complete information, send in the coupon below.

Please send me full information on the products checked below:

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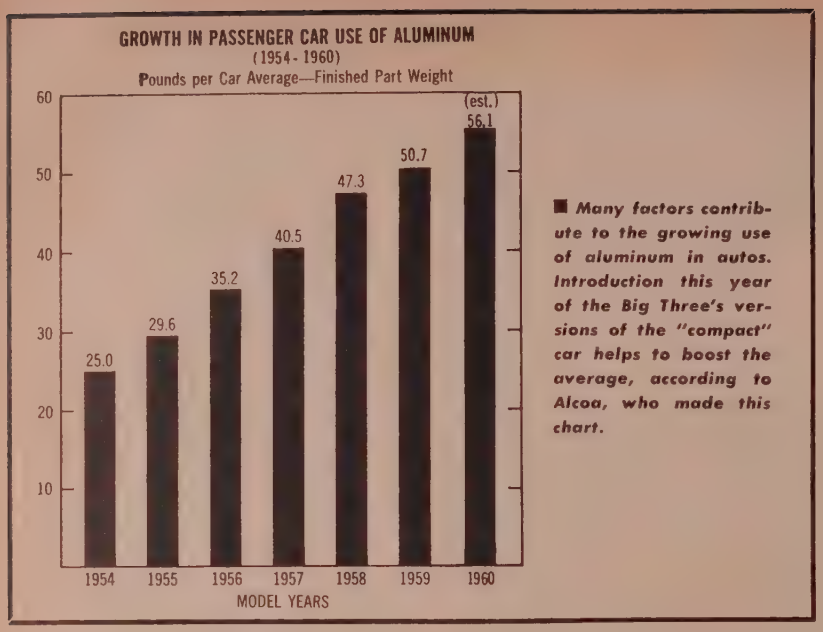
THE BRIGHT STAR OF METALS



■ ***Many factors contribute to the growing use of aluminum in autos. Introduction this year of the Big Three's versions of the "compact" car helps to boost the average, according to Alcoa, who made this chart.***

The bar chart on this page is all that is needed to show the steadily increasing consumption of aluminum by the auto industry. It is part of a detailed study by Alcoa which, based on a 1960 model output of 6,500,000 cars, estimates that aluminum consumption in the new cars will exceed 364,000,000 pounds.

Alcoa's tabulation of average car usage of aluminum comes close to Kaiser's figures in most cases. Alcoa's average of 56.13 pounds "per typical new passenger car" is practically the same as Kaiser's 56.2 pounds.

"Hidden Consumption"

"Although not included in the survey," Alcoa's commercial research division points out, "additional usage of aluminum for spare parts (about six pounds), alloying for zinc die castings, deoxidizing steel (about two pounds), and coatings for mufflers, should put total auto industry requirements well over 415,000,000 pounds."

Another use not included in the Alcoa study is the aluminum powder used in the distinctive new paints seen on many of the new models.

The auto industry believes that its five compact cars (Corvair, Falcon, Lark, Rambler and Valiant) will have combined sales of 1,500,000 this year. Alcoa reckons an average aluminum usage on these cars of 58.26 pounds for total aluminum consumption of almost 90,000,000 pounds.

The three newest compacts average 73 pounds of aluminum each, 17 pounds more than the average af all 1960 cars, by Alcoa's reckoning.

In its comparison of aluminum usage in the current and past two model years, Alcoa sees almost a 25% increase in use of the light metal in engine components this year over last — 15.75 pounds in '59: 20.60 pounds this year.

The average poundage used in transmissions has grown from 15.62 pounds in '58 to 18.41 pounds this year. As of 1960, engine and transmission uses of aluminum total 69.5% of the 56.13-pound average—up from 65.8% in 1958.

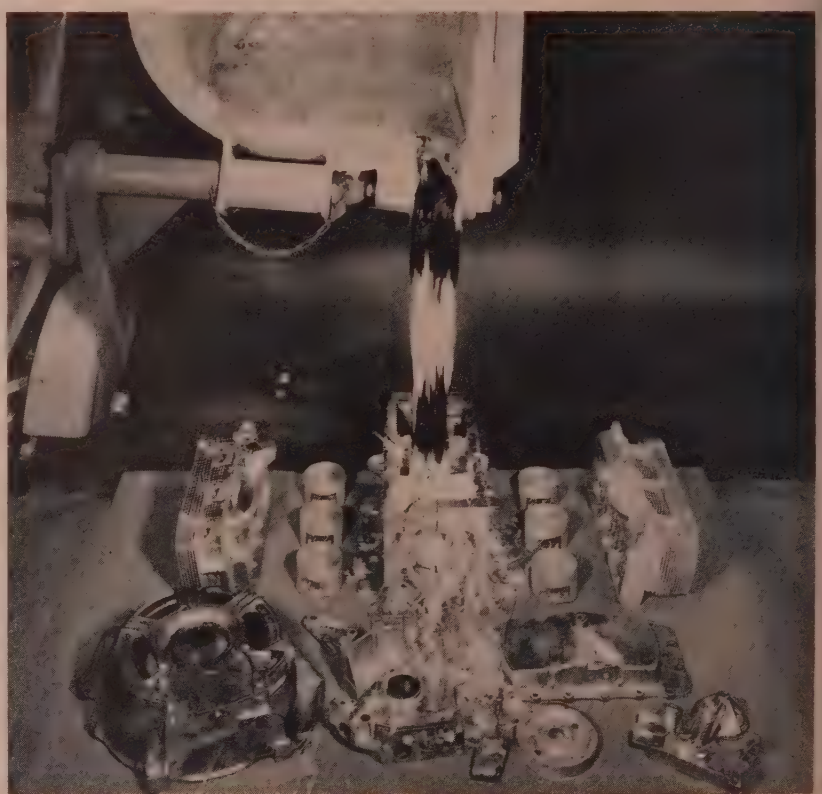
Tending to contradict earlier estimates the Alcoa study shows a reduced average weight of aluminum in hardware and trim applications—8.42 pounds per car this year, 10.18 pounds per car last. Perhaps this decline reflects a tendency this year toward molded body design, with less contrasting ornamentation.

In an effort to provide the automotive industry with anodized aluminum trim which is less costly to finish and more durable and attractive besides, Alcoa has introduced what it calls an "automotive trim finishing package" to Detroit's auto engineers.

The package outlines methods by which: Time required for the sealing of anodized parts may be cut as much as 200% through the use of a metal salt sealing solution; image clarity (the distinctness of the reflected image) is increased; unwieldy quality control procedures may be simplified (utilizing an electro-chemical approach), from 96 hours to 36 minutes, in some cases.

The package also includes recommendations to lower sealing temperatures from fume-producing highs of 208-212°F. to more workable areas of 195-200°F.

Image clarity tests have been inconsistent in the past, Alcoa reports, and so the company has developed a new machine capable of more accurate measurement of image clarity.



■ ***Photo shows metal going into many aluminum parts of six-cylinder, air-cooled Corvair engine. Rear-mounted engine uses an estimated 90 pounds of aluminum.***

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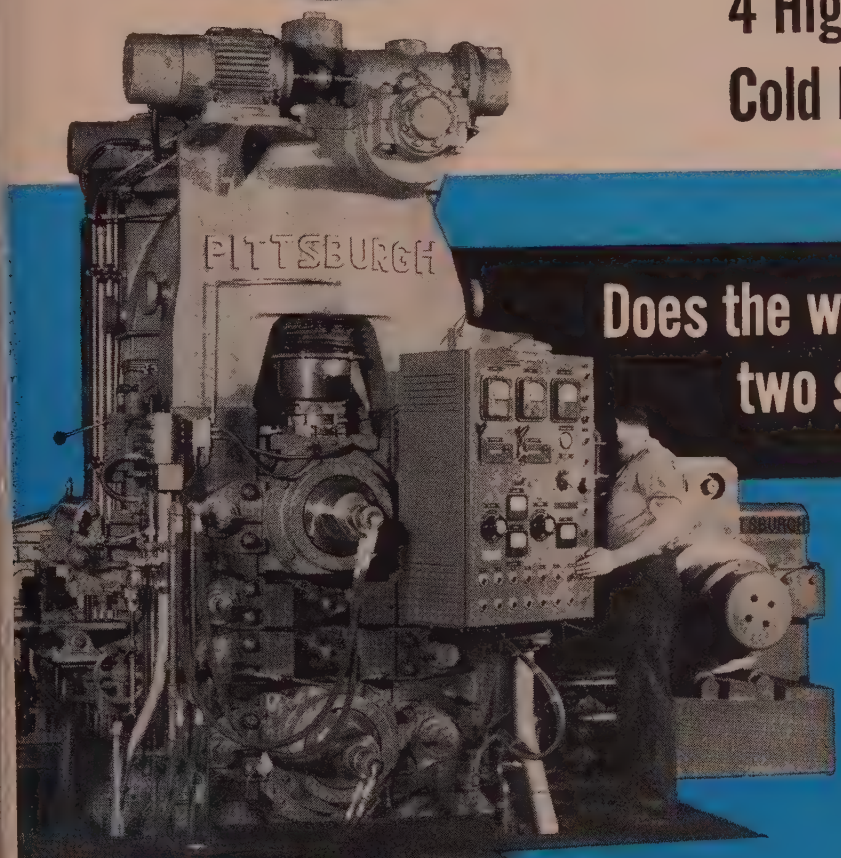
Combination 4 High/2 High Cold Mill . . .



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In magnesium welding . . .

NEW CONTACT TUBE SOLVES OXIDIZED WIRE PROBLEM

By C. R. Sibley,
Air Reduction Sales Co.,
Union, N. J.

High surface resistance of magnesium welding wire is no longer a problem, but progress in reducing wire's melting rate is slow, according to this Magnesium Association Conference paper.

ARC welding became a tool for joining magnesium parts as soon as there was the need for production fabrication of magnesium.

When magnesium welding wire was used in consumable electrode arc welding equipment, it was found that the melting rate of the wire was excessively high. This caused gas-shielded metal-arc welding of magnesium to be somewhat less successful than with most other structural metals. Welding wires of aluminum and steel do not melt at such high rates in an electric arc.

Melts Fast; Welds Fast

The exact reason for the extremely high melting rate of magnesium welding wire is not known, but one advantage is that it forces high welding speeds. High welding speeds, however, are not always desirable because inadequate fusion and porosity may develop in the magnesium deposit.

A second characteristic of magnesium welding wire is the rapid formation of oxide on its surface. This oxide increases surface resistance and restricts passage of welding current into the wire. It has been suggested that placing a conductive coating on magnesium wire at the time of manufacture would solve the oxide problem. It would extend the shelf-life of magnesium welding wire and provide a more uniform product.

Schemes to mechanically clean the welding wire have been tried, but this type of oxide removal develops chips which jam the wire feeding equipment if cleaning is done on the welding equipment. The arc welding of magnesium and its alloys has advanced steadily even without solutions to the problems of high melting rate and oxide formation.

Gas shielded metal-arc welding of magnesium was most aptly studied by a man who was devoted to the advancement of magnesium technology. The late Paul Klain contributed untold effort and time to the advancement of magnesium arc welding. In 1954, he brought before this Association a comprehensive summary of over three years' activity on the gas-shielded, metal-arc welding of magnesium.

This classic summary describes the variables in magnesium arc welding as well as process data. The principl cited by Klain are as effective today at the time he presented them. Ne developments will supplement his wo rather than supersede it.

This presentation is concerned wi the results of two recent studies made my company in the field of magnesiu arc welding. One study led to solution the oxide problem; the other indicat that control of the melting rate magnesium welding wire is possibl but insufficient effort has been appli to make this a commercial developme

Oxidized Wire Problem

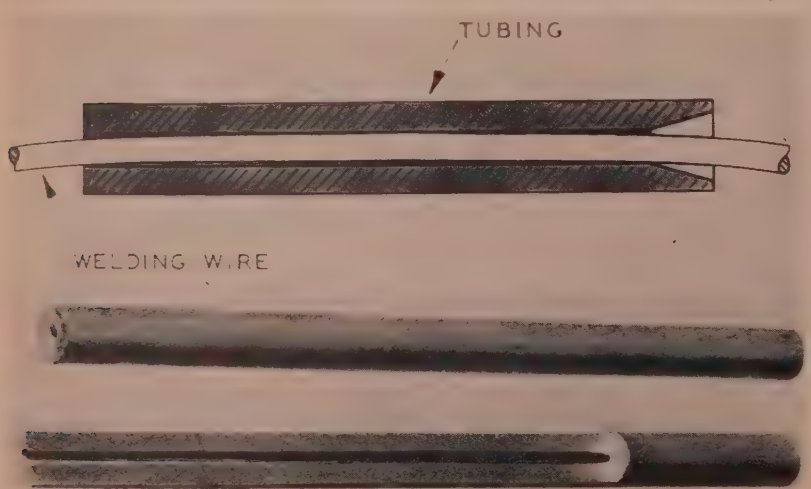
Magnesium welding wire stored f as long as seven years can now be us as effectively as freshly prepared wir Prior to this development, heavily ox dized wire proved unsatisfactory becau current could not be transferred easi and uniformly to the wire. A new co tact tube designed for gas-shielded met arc equipment solved the problem.

The older standard tube is made a solid copper alloy (Fig. 1). A wi passing through this tube must b smaller than the hole and therefo must be curved to a preset wire cast insure contact within the tube. A sket of this contact tube with a wire passi through it is shown in Fig. 2.

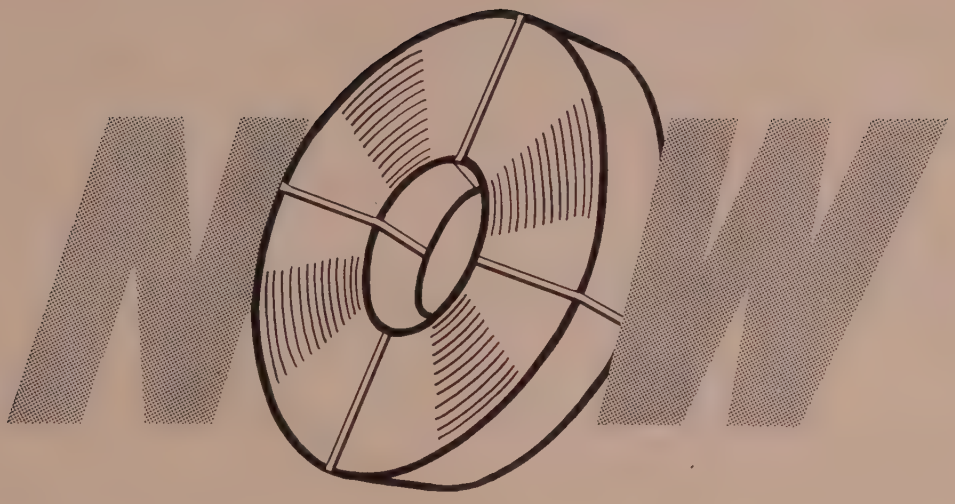
Electrical contact is made at the ex end of the tube because the curvatu of the wire ensures mechanical conta at this point. Stable operation of a wel ing arc with this tube requires that th point of electrical contact does n change from the exit end of the tub

With oxidized magnesium weldi wire, positive electrical contact is n maintained at the exit end of the tub and arc instability often causes failu in wire feeding and the welding oper tion. Two modifications of this standa tube have been made in an attempt t insure better electrical contact with th welding wire.

The tube was bent at the exit en and a slot was milled near that end t receive a pressurized shoe. A bent tub did not give improved electrical co



■ *Fig. 1 (photo) and Fig. 2 (cross-section drawing) show design of old standard contact tube used in gas-shielded metal-arc magnesium welding equipment. Wire fed through this tube had to be curved to a preset wire cast to insure electrical contact inside the tube.*



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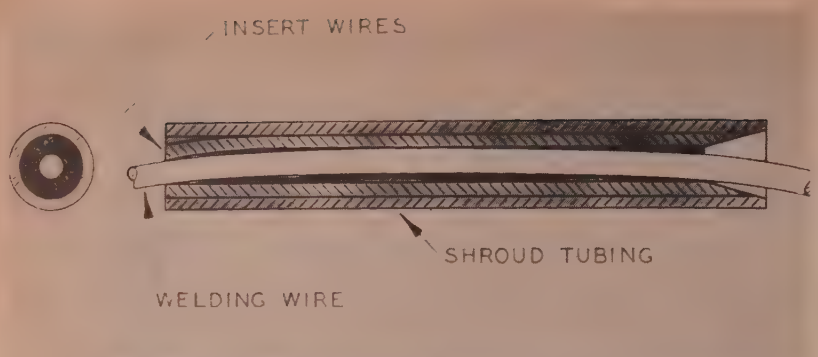


■ ***Fig. 3 (photo) and Fig. 4 (cross-section drawing) illustrate new contact tube having "floating" insert wires which assure uniform electrical contact with welding wire near exit end of the tube.***

tact, and the shoe-type tube frequently fouled during arc starting. Therefore, the need for a new contact tube design was realized.

The new contact tube has a series of interior wires which are fastened at the inlet end and float at the outlet end.* Complete and sectioned views of this wire insert contact tube are shown in Fig. 3. The wire inserts form the internal hole through the major portion of the tube and are free to move under the forces applied by the welding wire. This contact tube provides more mechanical contact area with the welding wire than the standard straight bore tube.

A sketch showing welding wire passing through the wire insert contact tube is shown in Fig. 4. Electrical contact is made at more than one point near the exit end of this tube because the welding wire can nestle between the insert wires. Since the insert wires are free to move under the forces of wire cast or electromagnetic fields, a wiping action occurs on the welding points of electrical contact; this produces a stable welding arc, even with heavily oxidized magnesium welding wire.

Melting Rate Lowered?

A commercial process to lower the melting rate has not been developed, but experiments show that it is possible. Techniques have been developed for lowering the melting rate of aluminum and steel by using liquid or dust coatings of emissive agents on the welding wire surface.

This necessarily is a straight polarity process since the action of the emissive agents is restricted to the cathode or negative terminal of the arc. Experiments with steel and aluminum welding wire have been reported. Since the same results have been shown to be valid for magnesium, the reported data and effects can be extended to magnesium.

Emissive coatings are required because these metals do not emit enough electrons to carry the welding current, even at their boiling points. This means that positive metal ions or other larger particles must carry the welding current across the arc. These heavy particles overheat the welding wire when it is the cathode and cause excessive melting.

The emissive agents freely emit electrons which reduce the number of ions in the arc and, like a flow of water, the electrons cool the electrode wire. These combined effects reduce the melting rate of the welding wire when it is the cathode.

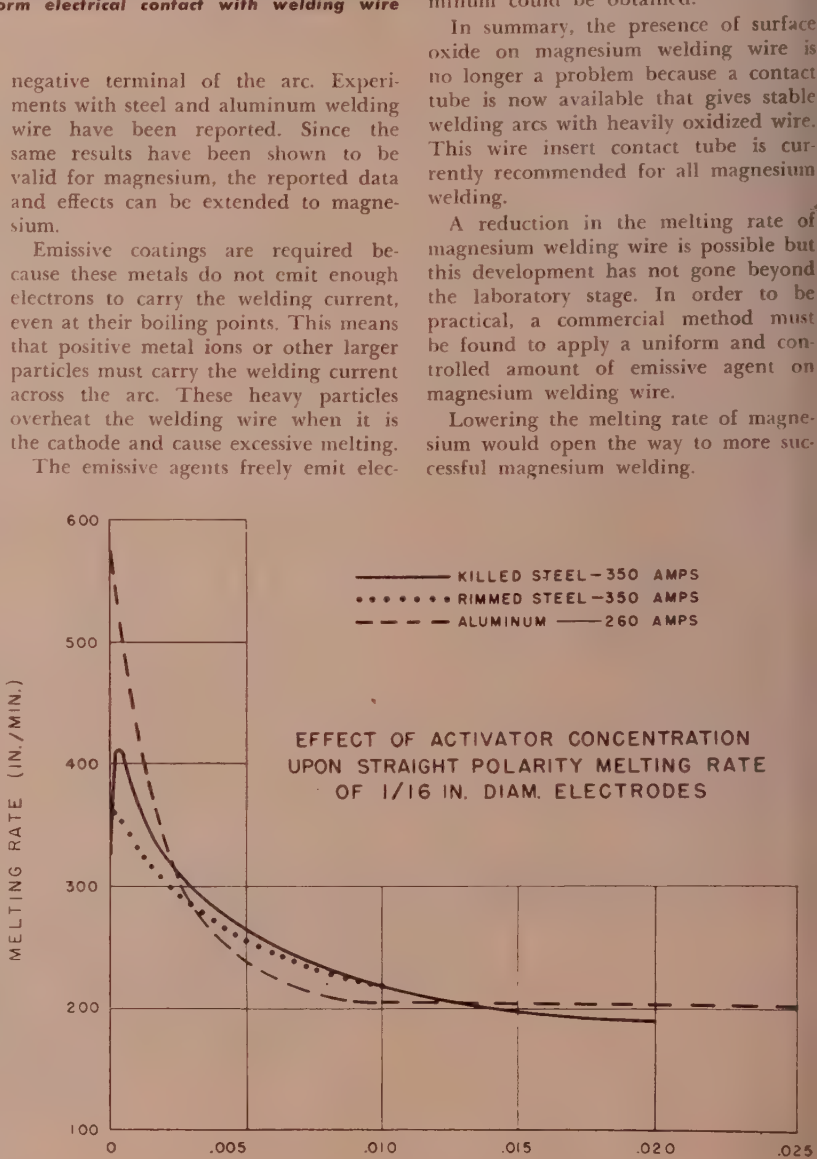
The progressive lowering in melting rate caused by increased additions of emissive agent on aluminum and steel welding wires is shown in chart below. At a certain concentration of emissive agent there is no further reduction in the electrode wire melting rate. But the rate at this concentration is considerably less than the rate without emissive agent.

An equivalent reduction in melting rate with magnesium welding wire would match the melting rate of aluminum. A lower melting rate with magnesium means that all position welding could be done with open arcs, and that the same freedom of operation as aluminum could be obtained.

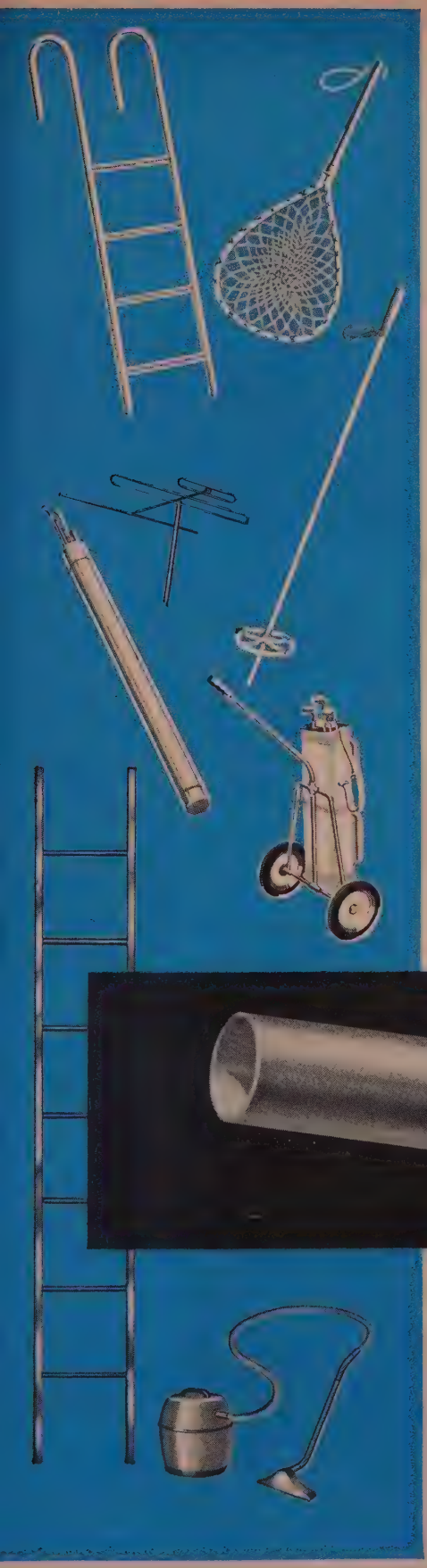
In summary, the presence of surface oxide on magnesium welding wire is no longer a problem because a contact tube is now available that gives stable welding arcs with heavily oxidized wire. This wire insert contact tube is currently recommended for all magnesium welding.

A reduction in the melting rate of magnesium welding wire is possible but this development has not gone beyond the laboratory stage. In order to be practical, a commercial method must be found to apply a uniform and controlled amount of emissive agent on magnesium welding wire.

Lowering the melting rate of magnesium would open the way to more successful magnesium welding.



*Patent applied for.



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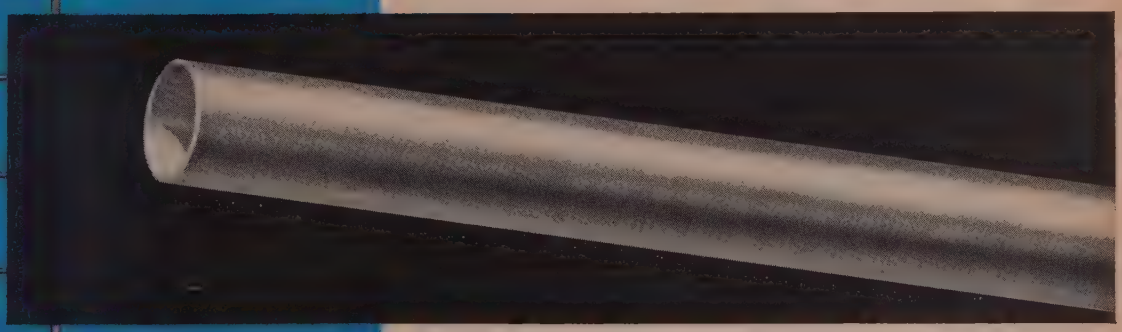

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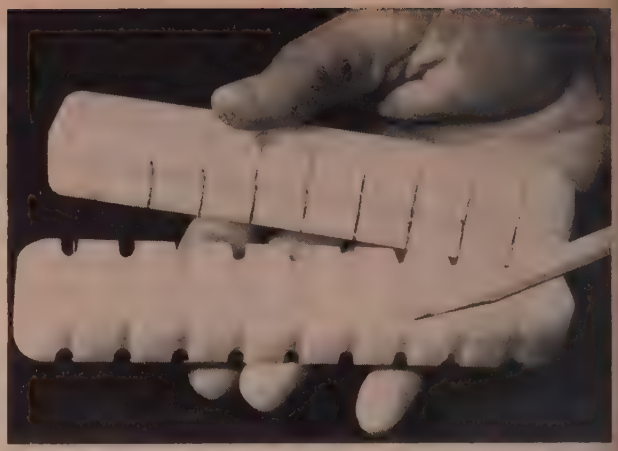
NYLON TOOLING *Aids Bending* OF ALUMINUM TUBING USED IN AWNINGS



NYLON tooling has solved an aluminum bending problem for a manufacturer of awnings. Four 17-inch radius bends are required in the fabrication of aluminum extruded shapes and welded tubing for each custom-made awning produced by Lite Vent Industries, Inc., Detroit, and its licensees in other sections of the country.

The company can supply aluminum components machine-bent to shape, but it's cheaper for the licensees to do the bending themselves. There's less scrap loss, and it costs less to ship straight sections.

The bends are the same whether done in the factory or in the field, but the tooling is different. Powered machines do the job in the factory, and the important thing here is to avoid crushing of the shapes and tubing. In the field, where the job is done manually, the trick is to accomplish the bends without marring the prefinished surfaces of the aluminum parts.

Nylon mandrels and shoes, fashioned from stock shapes of extruded Polypenco 101 supplied by Polymer Corp., Reading, Pa., solved both problems.

A protective nylon shoe, designed to fit between the form roller and the extrusion, was developed for the field. The shoe fits over the straight end of the extrusion and pivots about the point of contact of the forming roller and the shoe as the roller is pulled across the bending plate (see sequence illustration). Shape is scratch-free.

Bend Three At a Time

The factory bending machine forms three tubes at a time. They are placed over nylon mandrels and clamped to the table. An air cylinder draws the forming roller and the mandrels around the 17-inch radius of the bending plate. No galling occurs and the nylon supports the tubes against the form roller's pressure.

Factory mandrels had to have a high compressive strength to support tubing firmly during bending, had to be flexible to fit the radius of the bending plate, and slide smoothly on the inside of the tube. Bronze was tried, but it picked up aluminum and caused galling. Steel was unsatisfactory; it eventually took a set.

Several nylon mandrels were designed. By grooving or slotting the periphery, various degrees of flexibility were obtained. Least flexible are rods with a peripheral groove design, but they are easily machined. Narrow slotted mandrels are very flexible, but require drilled holes at the base of the slots to prevent notching. All mandrels have longitudinal grooves for clearance of internal flash on welded tubing.

Lite Vent uses stock nylon shapes to keep machining costs down. Polymer supplies the extruded bar to a tolerance of +.000 −.005. Little waste results when two 6-inch mandrels are cut from a 12-inch length of 1-in. square nylon rod. The full purchased length (16 inches) of the 1½-inch extruded shape is used for the field bending shoe. The shape's surface needs no machining.

Nylon 101 is milled at high speeds and feeds on standard equipment using conventional cutters. After milling, burrs are removed with a sharp knife and edges are rounded on a belt sander.

■ ***Protective nylon shoe has been placed between form roller and extrusion (left). As operator pulls roller across bending plate (center) shoe pivots about point of contact of forming roller and shoe. Unmarred shape (right) is produced.***

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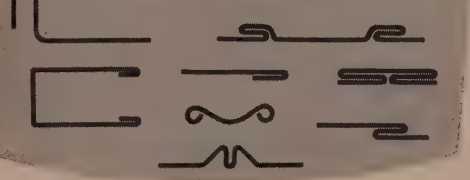

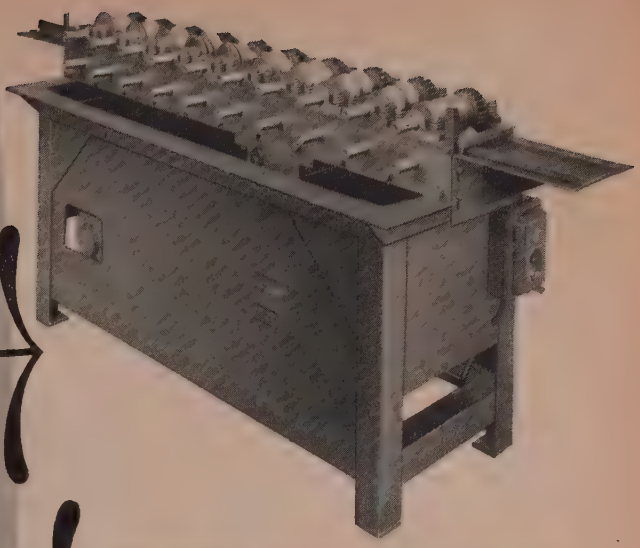

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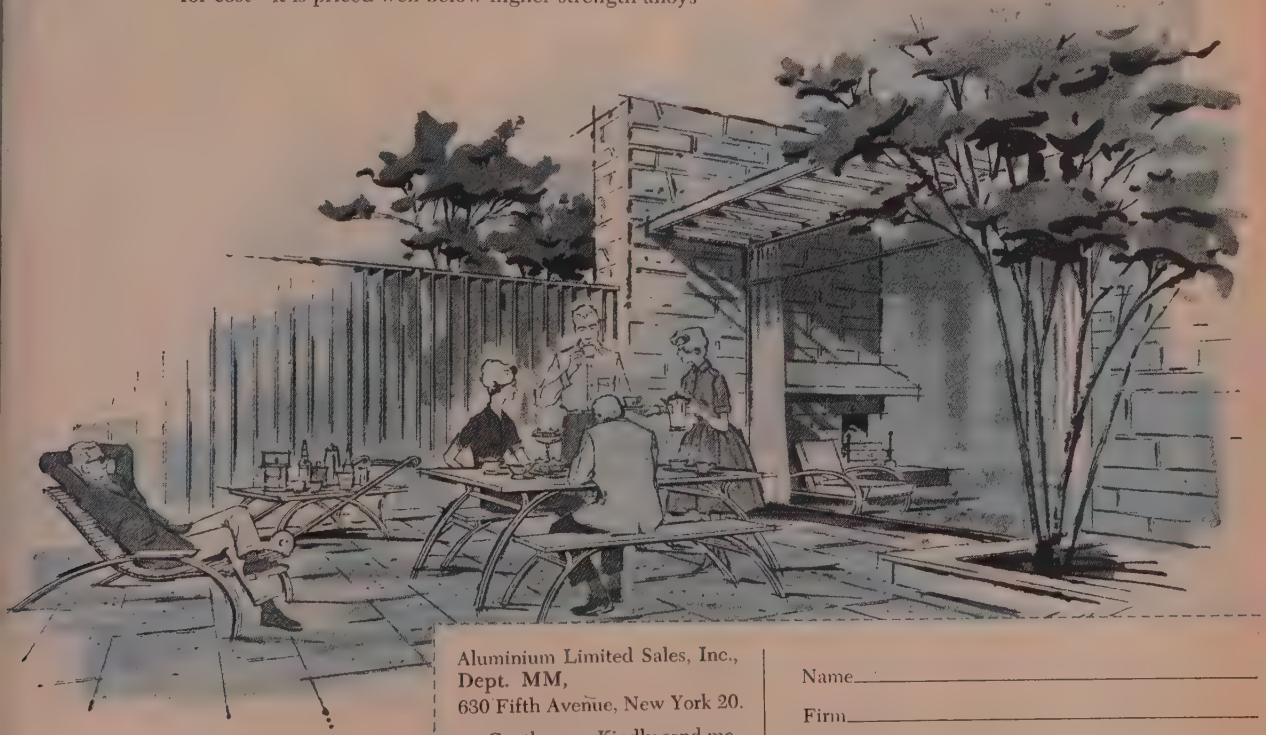

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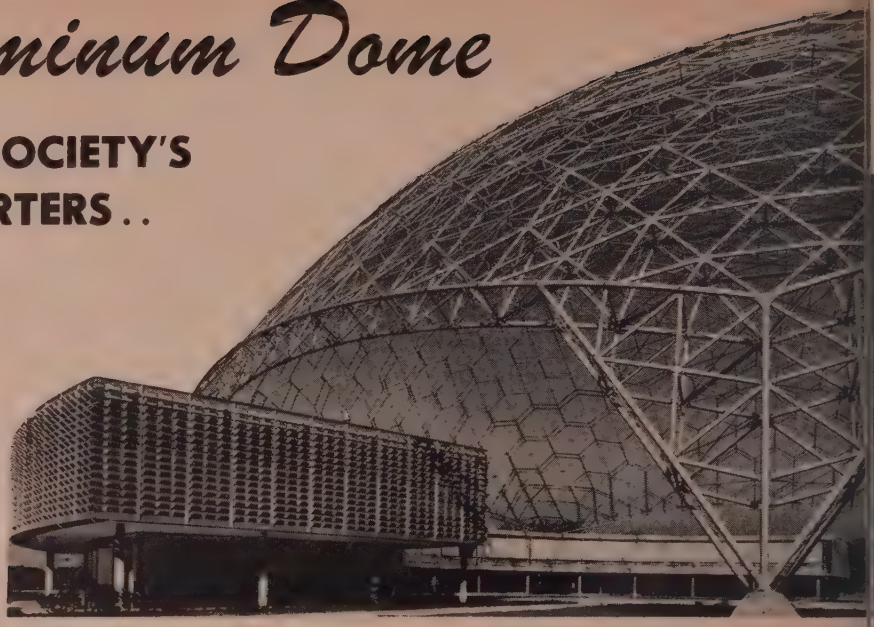

MAN'S mastery of earth's resources, man himself, and our planet's raw materials are all symbolized in the new headquarters of the American Society for Metals in Metals Park, Novelty, Ohio, 23 miles east of Cleveland.

A geodesic dome of extruded aluminum tubing, rising 103 feet above the headquarter's site, is a dramatic example of how metals can be fashioned to man's use through science and engineering. The hemisphere is 250 feet in diameter and is composed of 13 miles of aluminum alloy tubing and tension rods. Although structurally independent, it is essential to the building's picture.

The dome is comprised of 65,000 parts and weighs 166,000 pounds. Extruded aluminum tubing in 4 and 6-inch diameters was used. Alloy is 6061-T6. If laid end to end the tubing would stretch for 5¼ miles, while the extruded tension rods used would span 7¾ miles.

Metal was supplied by Kaiser Aluminum Corp.'s Halethorpe, Md., plant, and was fabricated by North American Aviation Corp.'s Columbus (Ohio) Division. Final erection was done by Mak Construction Co., Cleveland.

Hexagons composed of 4-inch tubes are the basic units of assembly. Actually there are two domes, one within the other, which produce a stable structure with a minimum number of members at each point. Domes are 30 inches apart and are linked by 4-inch tubing at the points of the hexagons, which are strutted radially by tension rods.

Five T-type truss pylons of 6-inch aluminum tubing support the dome. Four rest on concrete piers sunk from 24 to 77 feet into the ground, depending on position. The fifth pylon rests on steel.

During erection, bridge sections were first placed between pylons and bolted. Next, hexagons in horizontal sections were lifted in place by booms, and secured. Williams & Co., Inc., Cleveland, supplied hex aluminum nuts, washers, machine bolts, etc.

Tension Ring Combats Thrust

An interesting engineering aspect of the dome's construction is the tension ring linking the five pylons to resist the dome's outward thrust. The reinforced concrete support, submerged 18 feet, is 272 feet in diameter. Footings are 75 feet apart.

Used in the tension ring are four 1½-inch No. 11 pre-stressed reinforcing bar rods. They were arc welded in the field using 3/16-inch electrodes and filler rods. Welding was powered by two gas driven units rated at 200 amps each.

Stresses on the ring are calculated at 125,000 pounds on the four rods. Gillmore-Olson Co., general contractor, says that the dome can hold an 8-inch coating of ice on each of its components.

Designer of the dome is R. Buckminster Fuller, 64-year-old mathematician and engineer who is now a research professor at Southern Illinois University, Carbondale. He was formerly president of Synergetics Inc., Raleigh, N. C. This firm handled engineering, design, testing, analysis, and detail work on the structure.

Man himself is symbolized by the three-level glass walled, semi-circular building which houses the entire staff of the 31,000-member metals organization. The building used many metals in its construction including aluminum window frames, titanium table legs, steel columns, and stainless steel stairs, doors and sunshades. John Terence Kelly of Cleveland designed the building, its interior and landscaping.

An interesting aspect of the curtain wall construction is the method of butting glass directly into concrete to achieve a smooth plane around columns and other solid elements. Curvature of the building posed serious framing and glazing problems. All frames are on chords of different arcs, necessitating use of 112 sizes of various types. In some locations, expansion-contraction spaces between mullions are only 5/16-inch.

Extruded aluminum was used in the framing and was given an unusual anodizing time of 45 minutes. Experts felt that the headquarter's location called for neither the half hour period common for urban buildings, nor for one-hour anodizing common for structures fully exposed to harsh elements.

Alcoa supplied 36,000 pounds of 6063-T5 extruded aluminum and 900 pounds of sheet for construction of curtain wall elements. Gall Reversible Windows Co., Bedford, Ohio, produced the curtain wall grid. Also needed were 20,870 square feet of polished plate glass and 20,000 feet of neoprene gaskets.

Final symbolic element, and portion yet to be completed, is a mineral garden gouged seven feet into the ground and covering a 100-foot diameter circle. Laying directly beneath the dome, the garden will display 350 specimens of native minerals, all wearing descriptive labels. According to ASM, the garden represents earth's rich store of ore from which metals are produced.

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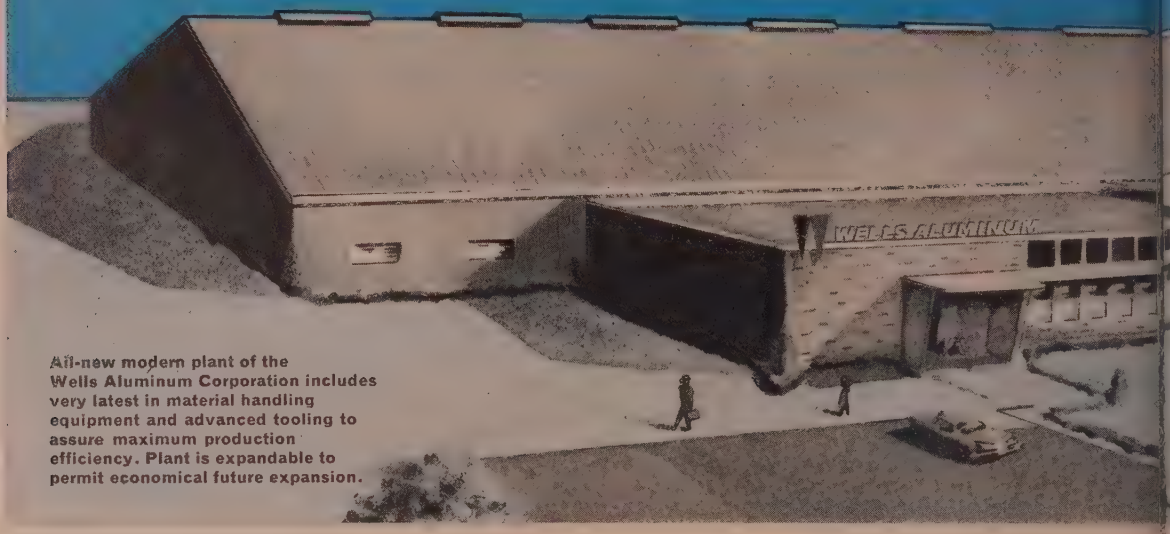

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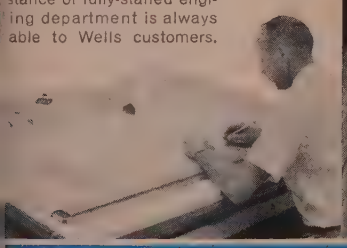

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How to Use Aluminum in .....

HEAT TRANSFER EQUIPMENT

by **Harry E. Phipps,**
Senior Quality Control Engineer,
Olin Aluminum Metals Div.,
Olin Mathieson Chemical Corp.,
Hannibal, Ohio

• The light metal's unique combination of properties, plus its low cost and ready availability in many versatile forms, makes it a natural for a broad selection of applications in heat transfer equipment. But care must be exercised in matters such as selection of alloy for certain applications. Such factors are covered in this article.

ALTHOUGH the use of aluminum in heat exchangers dates back more than three decades, there is a need to review the advantages of aluminum for greater use in heat transfer equipment because of the mounting costs of equipment and maintenance and the correspondingly lower profit margins for many chemical, petrochemical and petroleum processes. There are many untapped regions where aluminum could both enhance the engineering features of heat transfer equipment and reduce capital investment and maintenance costs.

The desire for a material that combined low initial cost, low maintenance cost, and superior resistance to a wide range of contaminants led engineers to consider aluminum for the myriad heat transfer applications where very few other materials are qualified. Some obvious advantages of aluminum and its alloys are:

Superior corrosion resistance—attested to by the successful use of aluminum in processes involving chemicals ranging from edible oils to nitric acid.

No discoloration or contamination—edible oils, stearic acid, waxes, rosin, turpentine, and synthetic textile chemicals are usually processed in aluminum equipment. Reason: Discoloration and contamination are minimized due to aluminum's corrosion resistance and the fact that most of its salts are either white or colorless.

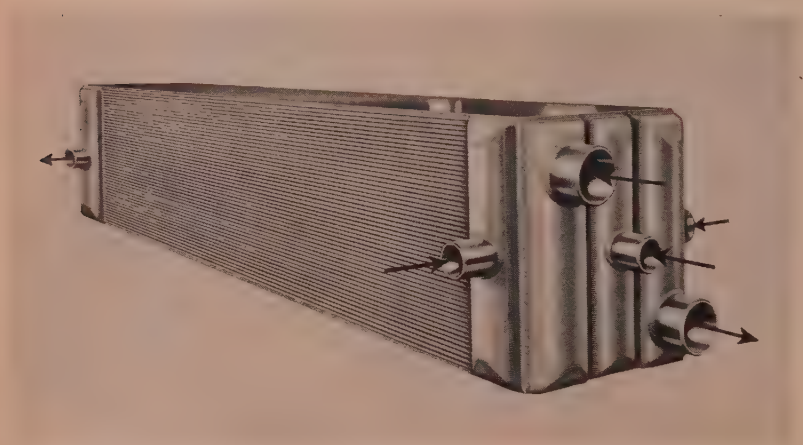
High strength—on an equal weight basis, aluminum alloys are up to eight times more rigid than steel. Their excellent low temperature properties make them ideal for low temperature heat transfer processes—in the production of tonnage oxygen and rare gases, for example—and in refrigerating processes using ammonia, sulfur dioxide and the freons.

The tensile and yield strengths of 3003-H14, for example, increase along with elongation at sub-zero temperatures. Aluminum alloys do not become brittle at temperatures as low as that of boiling hydrogen (—432° F.). New weldable alloys such as 5086 and 5456 offer welded joints with tensile strength about three times that of alloy 3003, commonly used in heat transfer equipment (see Table 1).

Light weight—since aluminum is about one-third as heavy as copper, yellow brass, or steel, substantial savings may be realized due to decreased shipping costs and foundation and support costs.

High thermal conductivity—due to its excellent corrosion resistance, higher rates of heat transfer have been recorded for aluminum tubes, primarily because of the absence of insulating corrosion products that deter heat transfer in other metals. In finned exchangers and partially jacketed vessels where the influence of non-condensing films and corrosion products is minimized, the high thermal conductivity of aluminum (117 BTU/(hr) (sq. ft.) (°F/ft) at 100° F compared to 26.2 for mild steel) results in a definite increase in heat transfer.

Ease of fabrication—aluminum is



■ *Fig. 1. This headered 5-stream brazed aluminum heat exchanger is capable of handling five fluids simultaneously. Manufactured by The Trane Co., such units are available for either cross-flow or counter-flow operation.*

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Table 1
Typical Mechanical Properties of Aluminum Alloys Employed In Heat Transfer Equipment (2)

Alloy and Temper (5	Temperature °F (3)	Tensile Strength, psi	Yield Strength, psi-2% Offset	% Elong. in 2"
3003-0 (4)	−320	33,000	8,500	46
	−112	19,000	7,000	42
	0	17,000	6,000	41
	75	16,000	6,000	40
	212	13,000	5,500	43
	300	11,000	5,000	47
	400	8,500	4,500	60
	500	6,000	3,500	65
	600	4,000	2,500	70
	700	3,000	2,000	70
3003-H14	−320	35,000	23,000	30
	−112	23,000	19,500	18
	0	22,000	19,000	16
	75	21,500	19,000	16
	212	20,000	17,000	16
	300	17,000	13,500	16
	400	13,000	8,500	20
	500	7,500	4,000	60
	600	4,000	2,500	70
	700	3,000	2,000	70
3004-0 (4)	−320	43,000	13,000	38
	−112	29,000	10,000	30
	0	27,000	10,000	26
	75	26,000	10,000	25
	212	26,000	10,000	25
	300	21,000	10,000	35
	400	14,000	9,500	55
	500	10,000	7,000	70
	600	7,000	4,500	85
	700	5,000	3,000	95
5154-0 (4)	−320	51,000	17,000	40
	−112	37,000	15,000	32
	0	35,000	15,000	28
	75	35,000	15,000	25
	212	35,000	15,000	30
	300	29,000	15,000	40
	400	22,000	13,000	45
	500	16,000	8,000	65
	600	10,000	5,000	90
	700	6,000	3,500	120
6061-T6	−320	60,000	47,000	22
	−112	49,000	42,000	18
	0	47,000	41,000	17
	75	45,000	40,000	17
	212	42,000	38,000	18
	300	34,000	31,000	20
	400	19,000	15,000	28
	500	7,500	5,000	60
	600	4,500	2,500	85
	700	3,000	2,000	95

(1) Data from Alcoa Aluminum Heat Exchanger Tubes, a publication of the Aluminum Company of America.
(2) Lowest strengths during 10,000 hours at testing temperature.
(3) It is recommended that for unfired pressure vessels fabricated from aluminum alloys the maximum metal temperature be approximately 400° F.
(4) For welded construction, the design is usually based on the annealed (—0) temper properties regardless of original temper.
(5) Properties for the clad products of these alloys are substantially the same as those for the base alloys.

easily and inexpensively machined, formed, cast, extruded, forged, welded and brazed by conventional shop methods, making possible such complex assemblies as the brazed, multi-stream heat exchanger pictured in Figure 1.

Non-toxic — properties of aluminum permit its use in the processing of drug, food and beverage products where corrosion products preclude use of certain other metals.

Non-sparking — properties of aluminum alloys add a safety factor in processes handling explosives or highly flammable solvents.

Non-catalytic properties of aluminum alloys result in minimum deterioration of sensitive chemicals due to oxidation, polymerization and decomposition.

Low maintenance cost — the fact that aluminum requires little routine maintenance and has a much longer service life in most applications makes it desirable for many heat transfer equipment uses. Innumerable examples show reduced maintenance costs of aluminum heat transfer equipment.

Low initial cost — to the surprise of many engineers, aluminum alloys offer an initial cost advantage over many other materials suitable for severe service. For example, small diameter clad 3003-H14 seamless tubes cost about 75% as much as comparable mild steel tubes, one-half as much as Admiralty brass, and one-third to one-half as much as cupro-nickel or stainless steel. Lower initial cost may also be realized due to aluminum's excellent heat transfer characteristics; i.e., a larger heat transfer area may be required for some other metal to transfer the same amount of heat as the smaller aluminum equipment.

Service conditions—since no one metal or alloy is acceptable under all service conditions, there are certain applications where aluminum should be used sparingly, if at all. Equipment that handles acetic acid is an example. At low temperatures, aluminum is widely used for stills, condensers and piping handling solutions of all concentrations, providing no moisture is present; at over 200° F, however, the metal is attacked ten times as fast as at the lower temperatures.

Handling Nitric Acid?

Conversely, processes handling nitric acid in concentrations *up to* 82% produce serious attack of aluminum. On the other hand, it is among the few materials used for service requiring contact with the acid in concentrations *above* 82%, including fuming red nitric acid.

The selection of alloy for a particular set of conditions is also important. In the production of hydrogen peroxide,

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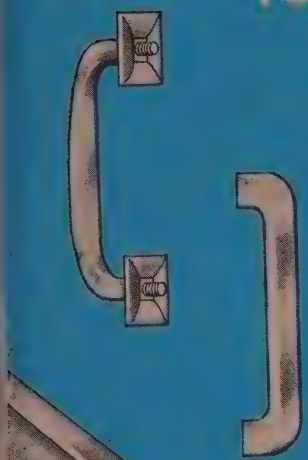

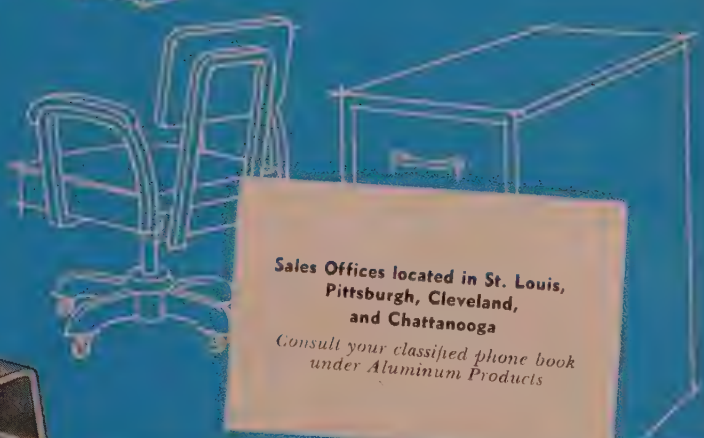

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Table 2 — Electrode Potentials of Various Alloys

Alloy	Potential-Volts 0.1 N Calomel Scale (2)
Magnesium	−1.73
Zinc (99.2%)	−1.00
Aluminum	
7072, Alclad 3003	−0.96
5056, 214	−0.87
5154	−0.86
5052	−0.85
3004, B214	−0.84
1100, 3003, 6151, 6053, 6061, 6063, 43	−0.83
356	−0.82
Cadmium	−0.82
Steel, Mild	−0.53 to −0.67 (3)
Cast Iron	−0.66
Lead	−0.55
Stainless Steel (13% Cr)	−0.52
Tin	−0.49
Brass (60-40)	−0.28
Copper	−0.20
Bismuth	−0.18
Stainless Steel (18-8 Types)	−0.08 to −0.19 (3)
Aluminum Bronze	−0.15
Monel	−0.10
Bronze, Silver	−0.08
Nickel	−0.07
Inconel	−0.06
Chromium	−0.40 to +0.18

(1) Data from Alcoa Aluminum Heat Exchanger Tubes, a publication of the Aluminum Company of America.
(2) Measured in an aqueous solution of 53 grams NaCl plus 3 grams hydrogen peroxide per liter.
(3) Potential varies with alloying constituents.

for example, high purity aluminum is among the few materials that does not catalyze its decomposition. On the other hand, alloys such as 1100, 5154 or 6063 are satisfactory for relatively short time contact such as in process piping or heat exchangers, but would cause excessive decomposition upon prolonged contact with the H_2O_2 solution.

Therefore, service condition variables such as temperature, concentration, varying effect with different alloys, and the presence of inhibitors should be taken into account when planning for trouble-free service from aluminum alloys. Literature is readily available relating to the performance of aluminum in various corrosive environments and service conditions.

Corrosion Mechanisms

Galvanic corrosion is the result of the flow of current from the positive electrode (anode) through an electrolyte to the negative electrode (cathode). Both electrodes are metals. Possible situations for this type of corrosion are:

A difference in solution potential between two adjacent areas on the same piece of metal.

Two unlike metals in electrical contact with each other in the same electrolyte.

Like metals in contact with dissimilar electrolytes.

Like metals in contact in two concentrations of the same electrolyte.

With any of these situations the more anodic metal will corrode; a galvanic current will flow from the anode to the cathode and a definite amount of the anodic material will dissolve in the electrolyte. The potential or driving force for the galvanic circuit is the difference in solution potential between the anode and the cathode (see Table 2).

Aluminum alloys should not be connected at random to heavy metals such as copper, nickel, or lead in an effective electrolyte, since these elements are cathodic to aluminum. If contact of aluminum with these metals in the presence of an electrolyte is unavoidable, electrically insulated joints or sacrificial sections are recommended to minimize corrosion.

Poultice Action

Poultice action is a corrosion mechanism involving contact of a metallic surface with a non-metallic. Even if the non-metallic does not contain corrosive substances, it can hold moisture in contact with the metallic surface for an extended time, creating an oxygen starved area at the point of contact which acts as the anode. The dry surrounding areas then become relatively oxygen rich, creating an oxygen concentration cell, which results in poultice corrosion at the moist, oxygen starved anodic area.

One special type of concentration cell is that encountered at the liquid level in tanks. Since the metal just below the surface is denied access to oxygen as compared to the metal just above the liquid level, corrosion occurs just below liquid level.

Poultice corrosion can be minimized in aluminum heat transfer equipment by selecting materials that do not absorb water and by providing adequate drainage. If heat exchange equipment is insulated with such material as 85% magnesia, felt, cork, or high soda glass wool, corrosion results when the insulation becomes wet.

The aluminum is much less susceptible to attack if these insulations are impregnated with chromate or dichromate inhibitors, by properly priming the metal surfaces, or by placing a moisture barrier between the insulation and the aluminum.

Heavy Metals Attack

Pitting or perforation occurs when traces of heavy metal ions such as copper or nickel are present in an electrolyte in contact with an aluminum surface. With tiny dissimilar metal couples in action, these ions are plated out at local cathodes on the aluminum surface and result in pitting-type corrosion.

Heavy metals attack can be combated by either using clad alloys to minimize pitting or by plating out the heavy metal ions in a container filled with aluminum chips placed upstream from any aluminum equipment. The presence of mercury should be avoided since it is very corrosive to aluminum.

For most applications there is a direct relationship between the rate of corrosion and the ratio of cathode area to anode area since the galvanic current is directly proportional to the ratio. As the ratio increases, so does the corrosion rate. This corrosion is particularly significant in the case of welds or rivets, where their area is small with respect to the area of the shell, and in instances where the anode, but not the cathode, is painted or otherwise insulated.

Equipment design should keep the ratio of the cathode area/anode area

Table 3 — Nominal Composition Of Wrought Aluminum Alloys Used In Heat Transfer Equipment

% Alloying Elements — Aluminum & Normal Impurities Remainder

Alloy	Copper	Silicon	Manganese	Magnesium	Chromium	Zinc
1100	(99% Minimum Aluminum)					
3003	—	—	1.20	—	—	—
3004	—	—	1.20	1.00	—	—
5052	—	—	—	2.50	0.25	—
5086	—	—	0.40	4.00	0.15	—
5154	—	—	—	3.50	0.25	—
5456	—	—	0.70	5.00	0.15	—
6061	0.25	0.60	—	1.00	0.25	—
6063	—	0.40	—	0.70	—	—
7072*	—	—	—	—	—	1.00

*Cladding for 3003, 3004, and 6061

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Requests for "we-need-it-tomorrow" deliveries seem to cram a foreman's order pad every day. Until now, immediate delivery has been a source of concern to the foundry industry because of lengthy baking and drying procedures.

Because of this, more and more foundries are adopting the bakeless CO_2 core-hardening process. Intricate cores can be made with CO_2 in a matter of seconds; completely finished cores (rammed, gas-hardened and removed) are produced in less than three minutes. Thus, CO_2 has become the propelling ingredient in production boosts throughout the country—so much so that it promises to soon become *the* method of core-hardening.

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Actually, it's simply a matter of supply and demand: the great demand today is for speed—therefore, CO_2. It doesn't just end there . . . the CO_2 process makes other core-making techniques old-fashioned. For example:

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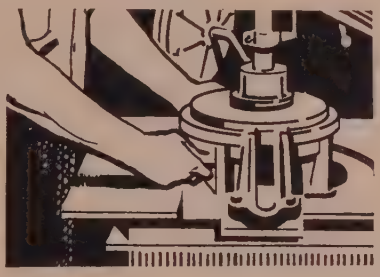
10. Adaptable for automation



CO_2 Ideal for Mold-Hardening, Too

In addition to these advantages, many foundries have discovered that CO_2 is just as beneficial in mold-making as it is in core-hardening. Dry sand molds sometimes require baking at 300° to 400° F. for periods up to 75 hours; the CO_2 process can do the same job at time-savings up to 95%. CO_2 molding also can save as much as 90% in machine-shop costs, cuts labor requirements, and works equally well on both large- and small-size molds.

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Table 4—Technical Data on Olin "Roll Bond" Products

1100 Alloy, "O" Temper — .030" Wall Thickness

Outside Tube Height	.180"	.180"	.180"	.200"	.200"	.200"
Tube Width	3/8"	7/16"	1/2"	7/16"	1/2"	9/16"
Volume — cc/10" Length	5.8	7.0	8.4	8.4	10.2	11.5
Cross Section Area — In²	.0354	.0427	.0514	.0514	.0623	.0704
Burst Pressure* psi	1200-2300	900-2100	800-1800	1200-2300	900-2100	800-1800

*Based on straight tube section.

as low as possible. Where this ratio is unavoidably high, as in the case of rivets or welds on exchanger shells, care should be taken to minimize the potential difference between the rivets or welds and the shell, preferably with the rivets or welds being slightly cathodic to the shell. This relationship should also be taken into account when designing heat transfer equipment with dissimilar metal contact between tubes, tube sheets, headers, shells and process piping.

With dissimilar metal combinations do not paint or coat the anodic area without also painting or coating the cathodic surface. Sacrificial anodes of an aluminum-zinc alloy such as 7072 or high purity zinc are often used to minimize the effect of dissimilar metals, and are normally bolted in the headers if the electrolyte is on the shell side.

Stress Corrosion

Certain high strength, non-heat treatable aluminum alloys, namely the high magnesium Al-Mg and Al-Mg-Mn types, are highly susceptible to work hardening, intergranular corrosion and stress corrosion cracking under certain conditions. The solid solubility of magnesium in aluminum at room temperature is such that excess magnesium in a supersaturated solid solution is generally precipitated out along the grain boundaries as Mg_2Al_3 by: (1) heating the alloy to 200-350° F. where solid solubility is not greatly increased, and (2) cold working past a critical limit.

The Mg_2Al_3 is much less corrosion resistant than the solid solution and, if present as a continuous grain boundary network, results in intergranular corrosion. High residual stress or applied tensional stress may then result in stress corrosion cracking along the intergranular fissures. Wrought Al-Mg and Al-Mg-Mn alloys containing more than 4.5% Mg are generally marketed only in annealed or hot rolled tempers and may be only mildly cold formed thereafter if high stress corrosion resistance is to be retained.

If the Mg content is less than 4.5%, good resistance to stress corrosion can be expected for cold rolled or cold formed items at room temperature. Alloys containing 3.0% Mg or less may safely be used for prolonged periods at elevated temperatures. If the Mg content is greater than 3.0%, however, these alloys should not be exposed to temperatures in excess of 150° F if continued resistance to stress corrosion is to be expected (see Table 3).

Aluminum Equipment

Aluminum seamless and welded tubes are available in bare, inside clad, outside clad, and two-sides clad 3003-H14. Bare tubes are recommended for service where electrolytic action is not likely to occur and are the lowest cost aluminum heat exchanger tubes meeting ASTM specification B234. Inside clad tubes are recommended for service where cooling water flows through the tubes. Outside clad tubes are designed for use where cooling water flows on the shell side of the exchanger. The two-sides clad tubes are adaptable for most any operating circumstances.

For special applications, tubes are available in alloys such as 1100, 5050, 5052, 6061, 6062 and 6063 where best advantage can be taken of their particular properties.

Shells and headers are generally available in bare 3003-H112, clad 3003-H112, 3004-H112, 5052-H112, 5083-H114, 5086-H112, and 5154-H112, and in 1160 or 1100 for special purposes.

Alloys recommended for use in the fabrication of tube sheets are bare 3004-H112, clad 3003-H112, 5083-H112, 5086-H112, bare 6061-T6 and clad 6061-T6. Baffles are generally fabricated from either bare 3003-H14 or clad 3003-H14.

Miscellaneous items such as tie rods, fittings and flanges for shell and tube exchangers are commonly fabricated from 6061-T6.

Roll Bond

Olin Mathieson's Roll Bond*, a comparatively new tool for engineers confronted with unusual heat transfer problems, offers unique and inexpensive solutions to many of these problems. This ingenious product can be produced in almost any desired pattern within the physical limits listed in Table 4, and is available in 1100, 3003, clad 3003 and clad 6061 alloys.

A multiplicity of tube sizes are available such as a typical .030" wall x 3/8" wide 1100-0 tube that will withstand up to 2000 psi for a straight tube section. Heat transfer properties of this product are as good as the metal itself and

*Roll Bond is a registered trademark of Olin Mathieson Chemical Corp.

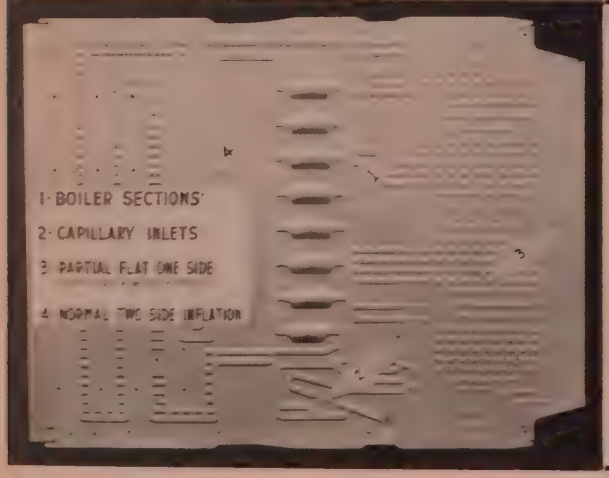

Fig. 2—"Roll Bond" Products Available(1) For Heat Transfer Applications

Alloys:	1100, 3003, Clad 3003, 6061
Maximum sheet size:	36" x 110"
Maximum pattern size:	33" x 106"
Thickness (2):	.045" / .120"
Temper:	annealed
Passageways:	two sides inflated or one side flat
Number of layers:	two or more

(1) Data from "Roll Bond Products," a publication of Olin Mathieson Chemical Corp.

(2) Thickness of uninflated, bonded composite.

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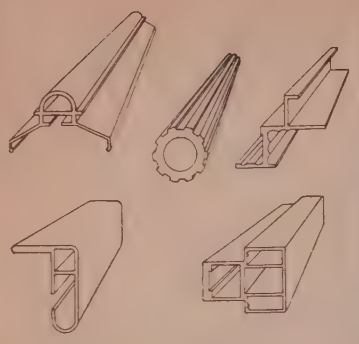

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are not encumbered by weld areas of poor thermal conductivity.

Roll Bond offers advantages over integrally cast tube strip in that many complex tube patterns are available that are impossible by the latter method. A typical Roll Bond product is pictured in Figure 2.

For applications where the added efficiency of an extended surface tube is desired, aluminum finned heat exchanger tubes offer many advantages. Extruded, brazed, spirally-wound and internally expanded plate fins are available in a large number of fin configurations and sizes. This type tube is used extensively in heat exchange processes involving gases.

Aluminum alloys are also successfully employed in stills, distillation columns, condensers, reactors, preheaters, coolers, evaporators, steam jacketed kettles, and steam traced piping.

Cleaning Exchangers

Aluminum heat exchange equipment can be cleaned with inhibited alkaline or inhibited acid cleaners. The deposit to be removed will dictate the method used. In either case, the period of contact should be kept to a minimum and followed by a thorough water rinse.

Mechanical cleaning, such as with water jets, brushes or wet sand blasting, removes soft or loose scale. If brushing or sand blasting is used, care should be taken to prevent piercing of tube walls, and to prevent excessive removal of cladding from clad alloys.

Cooling waters in the pH range of 4.5 to 8.5 are not corrosive to aluminum alloys. Where the pH is outside this range, the presence of chlorides or salts or heavy metals determines the corrosion rate. The effects of pH can be minimized by using inhibitors such as silicates, phosphates, chromates, nitrates, nitrites or combinations of these.

Systems treated with caustic soda, soda ash or sulfuric acid, and bactericides are also compatible with aluminum alloys, provided the former group are added under proper control and the bactericides contain no heavy metal salts. Clad aluminum tubes provide adequate protection in most cooling waters, even those containing heavy metal ions.

Clad Products

The use of clad alloys to combat corrosion is widespread. Under conditions that normally promote pitting or perforation of bare alloys, the service life of a piece of equipment will be extended many times through the use of a clad alloy.

Clad products consist of a sandwich of two alloys with the core alloy providing the strength and the cladding providing cathodic protection. A variation is a clad product in which the cladding on one side provides protection for the core and the cladding on the other side is of a brazing alloy that will simplify construction of the equipment. An example is a product having a 3003 core, 7072 one side and 4043 brazing alloy on the opposite side.

The clad aluminum alloy probably of most interest to the heat transfer industry consists of a 3003 core and 7072 cladding on either one or two sides. Since the 7072 cladding is anodic to the 3003 core, the 7072 will preferentially go into solution under corrosive conditions, and corrosion will not penetrate into the core as long as there is a reasonable amount of cladding still attached to the core alloy. Since this protection is galvanic in principle, the cladding need not be continuous to be effective.

Summary

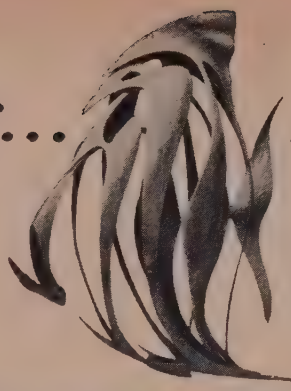
The following precautions should be followed when designing for trouble-free service from aluminum and its alloys:

1. If dissimilar metals must be used, select them as close as possible in the galvanic series.
2. Insulate dissimilar metals wherever possible. Paint, plastic coatings and gaskets at joints are helpful.
3. Do not combine dissimilar metals where the area of the more anodic metal is small in relation to that of the cathodic metal.
4. With dissimilar metals combination, do not paint or coat the anodic area without also painting or coating the cathodic surface.
5. Wherever possible, install protecting anodes of a sacrificial metal to minimize galvanic corrosion.
6. Employ clad alloys to minimize perforation-type corrosion.
7. For solutions that normally tend to be corrosive to aluminum, employ chemical inhibitors.
8. Where poultice action is likely to occur, select materials that do not absorb moisture and do not contain soluble corrosive substances. Design equipment for proper drainage.
9. Choose alloys with respect to their stress corrosion resistance characteristics.
10. Choose alloys with respect to the solutions being handled.

For unusual heat transfer problems in severe service conditions, the aluminum industry offers many years of experience in fabrication, design and corrosion control of heat transfer equipment that are readily available for their solution.

THERE ARE

shapes...



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How British Designers Use ALUMINUM IN FURNITURE

Aluminum castings put to good use in furniture for schools and homes. One line employs "K-D" principle. Other new approaches proposed in paper given at "Aluminum in Building" symposium sponsored by the Aluminium Development Association.

by B. McGeoghegan, Industrial Officer, Council of Industrial Design; and J. C. Bailey, Assistant Technical Director, Aluminium Development Association

← School desk with locker and chair are used in many English classrooms. Aluminum frames are die cast and covered with hardwood.

ENGLAND'S furniture designs have changed greatly in the past 12 years. New materials ranging from African woods to aluminum have played an important role in this switch from yesterday's simple economical pieces to today's sophisticated styles.

Aluminum's many fabrication possibilities have spurred its use in furniture frames, accessories and complete units for office, schoolroom and terrace.

In England, furniture has been made of, or decorated with, aluminum extrusions, sheet, castings, stampings, expanded metal and tube—one of the strongest shapes available for the amount of metal used. Pieces have been riveted and bolted, brazed, fusion and resistant welded, and, more recently, glued with adhesive resins.

Many finishes have been applied to the fabricated pieces. They have been etched and color anodized to provide pleasant matt textures. They have also been coated with baked enamel, paint, and/or plain or embossed plastics. Many times the natural aluminum surface is merely decorated by mechanical means such as polishing, buffing, scratch brush finishing, etc.

Aluminum is a modern material and, from a symbolic viewpoint, expresses a modern approach to furniture design. The metal is compatible with modern plastics, textiles and moldings, and blends with the new exotic woods, stone, and other materials used in today's interior decoration.

Aluminum helps cut costs, too. The difference can be seen by comparing an upholstered chair produced by British manufacturers in both aluminum and wood. With a cast aluminum frame and plastic upholstered wooden seat the selling price is £4 10S 6d ($12.67); with a wooden frame it is £4 16S 6d ($13.79).

Aluminum is being put to more and more uses with each churn of the designer's brain. The strong, light metal is being used to furnish England's classrooms. Examples are the desk and chair shown above. The units are die cast, given a baked enamel finish and topped with hardwood.

Die Casting Used Because . . .

The die casting process was chosen because it offers a wide latitude in design and is economical for mass production. The alloy used can be readily die cast into long, thin sections.

Ernest Race is an English manufacturer who uses another economical mass production casting process to make components for tables and chairs (see picture). The design and production methods employed provide maximum strength where needed with minimum use of metal.

One design feature of Race furniture is the "knock down" principle which enables the products to be assembled by the consumer. The separate components are delivered in a package much smaller than needed for the standing piece, resulting in freight and packaging savings. Race's fabrication methods simplify final assembly.

Lighting fixtures have put aluminum to good use, too. Silver and gold anodizing plus the variety of shapes that can be obtained from aluminum tube have speeded this application. Also, light gauge tube and shapes are competitive with traditional copper-base alloys, brass and bronze. Door hardware is another area where aluminum has started to compete with these more traditional metals.

Aluminum's ability to stand up under the attack of the British climate has sparked its use in lawn furniture. Its ductility, natural color, and weldability

■ *Samples of Race tables, with and without drawers. Tops are of hardwood; frames are cast aluminum. Components are shipped to consumer who assembles them.*

eep production costs down. Costs have een further cut with the advent of new achines that produce low cost tubing.

Other British firms are producing hairs and tables for hotels and public ooms; trays, screens, etc.; kitchen cabiets and sinks; door hardware and fitings; and venetian blind slats.

Aluminum's future in home furnishngs is unlimited. Aluminum could rid he manufacturer of the headache he as had since he removed the frame round mirrors and replaced it with metal clips. Here, a cast or extruded luminum frame could be made to fit he mirror no matter how complicated he profile. Similar framing could be sed on other pieces of furniture in the room.

Motels have numerous uses for aluminum. In the bathroom the vanitory could hang from the wall on an aluminum bracket, and the washbasin could be of porcelain enameled aluminum. In the main room, aluminum drawer pulls, hinges, windows and mirror frames could blend with aluminum furniture to give the room a crisp appearance.

The kitchen will become another natural habitat for aluminum. When coated with non-chipping porcelain enamel, aluminum provides hard-wearing, easily cleaned surfaces. Deterioration because of the humid atmosphere of kitchens and bathrooms is not a problem because paint lasts longer on aluminum than on other materials, and rust stains never appear.

■ ***Here is an example of aluminum used in lighting fixtures. Unit has pendant fitting with gold anodized ceiling plate and reflectors of aluminum. Radial black slats are of wood.***

One important possibility is designing wall-mounted kitchen components. This would not only enable working height to be adjusted to individual needs, but would also simplify cleaning and overcome the problems of uneven floors, especially in old homes.

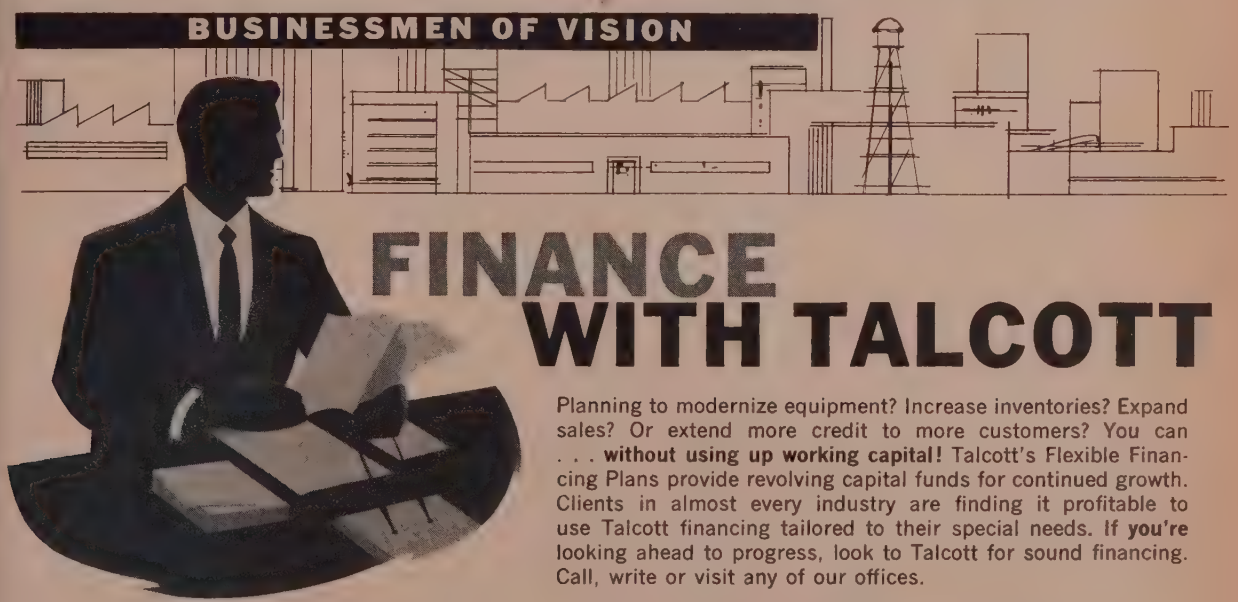
Another possibility is producing "knock down" components for kitchens, thereby opening a new export field. Modules could be soundproofed by constructing double-skinned panels stuffed with foil. Fittings and other accessories would be made of aluminum, too. Type of finish would be optional.

Aluminum can also aid hotel management. Wardrobes could be designed for wall mounting, or the lightweight units could be built as temporary dividing walls between bedrooms. This would provide great bedroom flexibility. A family with small children may need a room large enough for everyone. A flexible dividing wall incorporating wardrobe and other furniture could be placed accordingly.

Portable beds of aluminum frames and folding legs would help hotels during crowded seasons. And their light weight would enable maids to handle the beds without help from male labor.

Lawn furniture is already widely produced from aluminum, but many more styles and types of pieces are in the offing.

Though aluminum has already found numerous uses in England, its applications will continue to grow.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Building products maker ready

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DURING the past several years, the aluminum window and curtainwall manufacturing industry has racked up a remarkable growth record, not only in dollar volume, but also in the physical size of the products made.

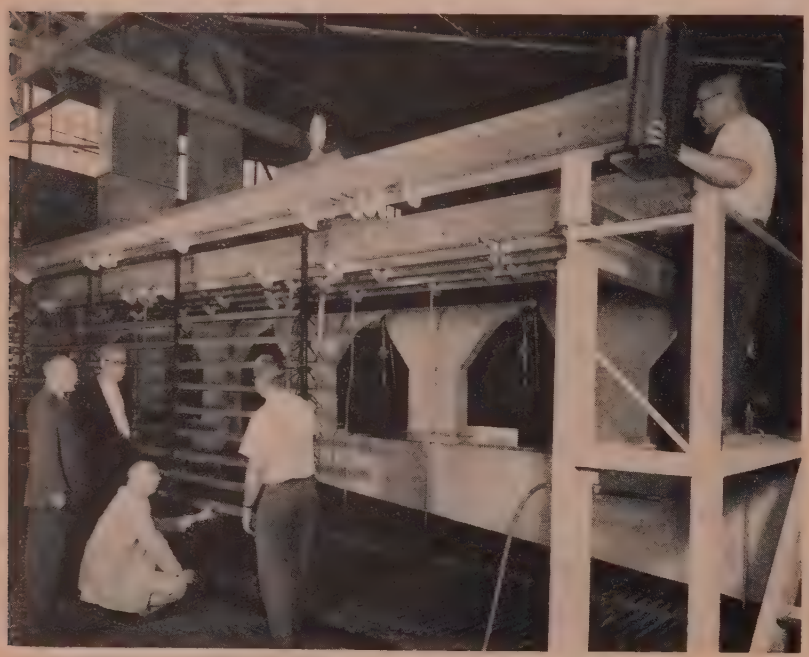
Those alert manufacturers who spotted these trends early and planned accordingly are in an enviable competitive position today. This is particularly true of companies that have installed efficient finishing equipment — especially anodizing tanks — capable of handling today's outsized windows and curtain walls. The Adams & Westlake Co., Elkhart, Ind., is a good example.

Five years ago it became apparent to Adlake's management that their aluminum window and curtainwall work would reach dimensions far exceeding the capacity of their aluminum finishing line.

A long range program was set up to analyze the long-term business outlook and determine future finishing requirements of the company's building products and transportation sash divisions. In May of 1958 top management agreed that the time had come to replace the existing finishing department with a modern aluminum finishing line which could cope with the massive extrusions needed in the construction of curtainwall units.

Contracts were let in December, 1958 for a quarter-million dollar installation that is now the largest sulphuric acid anodizing system in Northern Indiana.

The system which was put in operation in June 1959, is made up of 12 tanks, 30 feet long by 7 feet deep and varying in width depending on function. For example, all cleaning, etching and rinsing tanks are 3 feet wide, while the anodizing and sealing tanks are 3 feet, 10 inches and 4 feet, 6 inches wide, respectively.



■ *Adlake officials are shown inspecting part of the company's expanded anodizing facilities following completion early last summer. Modernization and expansion totaling $250,000 place the company in an improved position for today's larger fenestration jobs.*

Aluminum Sealer Tanks

The sealer tanks are lined with alloy 1100-H14, 3/16-inch aluminum and are heated by eight aluminum pipe coils. Heat for the system is supplied by a 200 hp gas-fired Pacific hot water boiler with Sarco electric temperature controls. The tanks are fed by a duplex deionizer with a total capacity of 12,000 per regeneration.

The anodizing tanks are lined with 3/16 inch thick natural rubber, and are cooled by 14 type 316 stainless steel plate coils which are also used as cathodes. Additional cathode area is gained with the use of lead strips between the coils.

Protection of the cathodes is provided by a basket constructed of rigid PUC pipe covered with neoprene mesh. This has the added advantage of supplying the air agitation through the framing of the basket.

Each of the remaining tanks is made of 3/8-inch mild steel with stainless steel linings where required. All are heated or cooled with plate coils.

Current is provided by a pair of 24-volt, 4000-amp. motor generator sets which were part of the original finishing system. A welded aluminum bus bar, extruded by Adams & Westlake, connects them to the new unit. The company is presently replacing these motor generator sets with two 7500-amp. 24-volt sets in order to increase anodizing capacity.

Racking of extrusions is accomplished by use of several types of titanium tipped, coated racks with aluminum splines which are bolted to the work rods. Due to the variety of shapes and lengths of extrusion used in the build-

g products industry, the racking of rts is a never-ending challenge.

The work rods themselves are made two 9-inch aluminum channels and e handled by a pair of 2-ton, remote ntrolled bridge cranes. Two indi-dually controlled hoist motors on each ane make it possible to drain the ork as it emerges from this tank, thus educing drag out.

Ventilation of the new finishing sys-em is of the push-pull variety and all omponents are of fiberglas. Fresh air s introduced on one side of the tanks nd fumes are exhausted from the ther. Hoods are of standard size, bolted o the collecting chamber, making re-placement relatively simple. Vent noise s minimized by mounting all exhaust ans on the roof of the building.

During the first few months of op-eration a buildup of etchant was ap-parent in the ducts serving the caustic tch tanks. This has been eliminated by the installation of spray heads which wash the material into a sump for easy removal.

To Aid Quality Control . . .

Quality control has been further improved by the addition of a Dermitron, which measures thickness of the anodic film on finished material. Thicknesses of electroplated and organic finishes can also be measured with this instrument, made by Unit Process Assemblies, Inc., New York. A photo-electric reflection meter is used to assure perfectly matching finish colors.

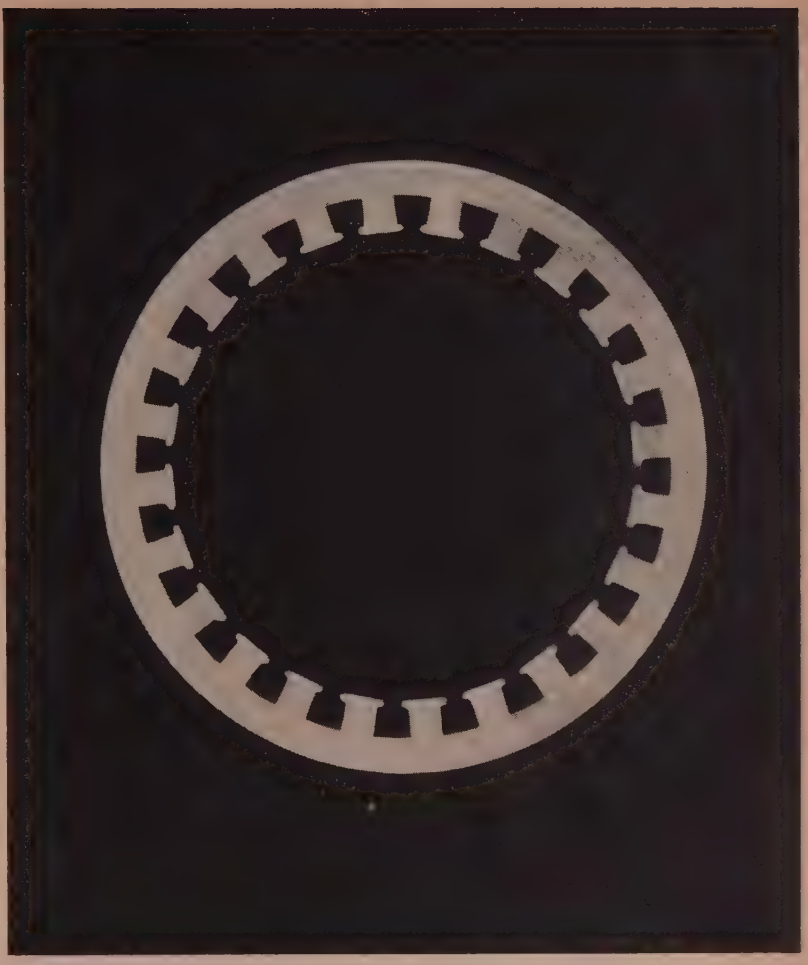
The use of steel in Adlake fenestration products is limited to anchors and a few reinforcements. The windows and curtain walls are solid aluminum.

Color work other than 2020 gray is not presently done in Adlake's new system; but, provision has been made for the addition of color tanks when required.

Every possible precaution against mechanical failure of the system has been taken. Every important piece of equipment has its duplicate installation which could continue to function in event of a breakdown. Thus, there are two cranes, two etching tanks, two anodizing tanks, two seal tanks, and two deionizing tanks.

"We expect the added efficiency and greater capacity of this new equipment to place Adams & Westlake in an even better position to compete for large scale fenestration orders," a company official explained.

Adams & Westlake Co. was established in 1857. Originally, the firm manufactured railroad supplies such as stoves, lanterns, etc. It still has a railroad division, but has added two others —the building products division and the relay division.



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WHEN the Oriana goes into operation in the new joint Australian & Pacific service developed by the Orient Line and P & O, she will be noteworthy not only as one of the most advanced passenger ships in the world, but also for the amount of aluminum used in her construction.

By adopting welded aluminum fabrication for the entire superstructure above the strength deck, enough weight was saved to allow the passenger accommodation to be increased to the extent of a complete deck. This was accomplished without reducing stability.

In the eight tiers of deckhouses, three of which extend the full 450-foot length of the superstructure, 1000 tons of aluminum plate and extruded sections were used. About 870 tons of the metal was supplied by Northern Aluminium Company Ltd.

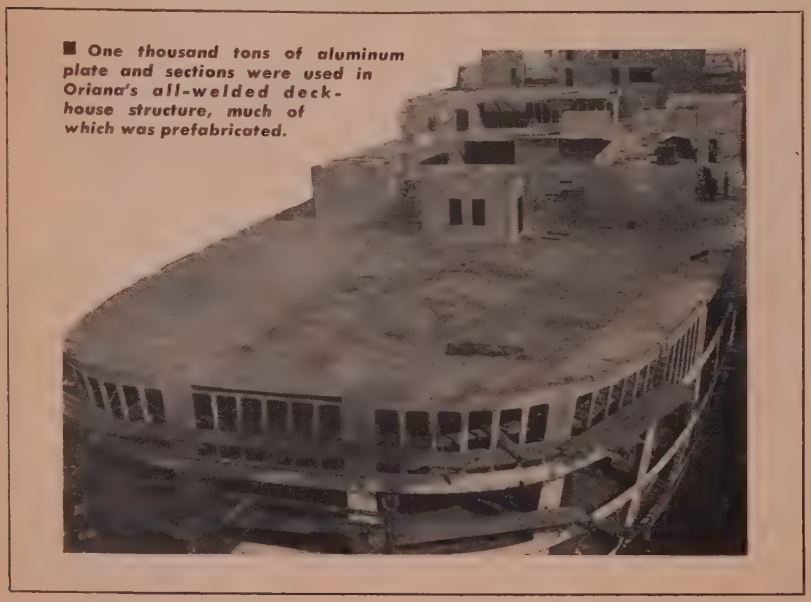
Planning for the use of aluminum on this scale began several years ago, and preliminary investigation to settle such questions as the best welding procedures and techniques to be adopted was undertaken in 1955. In that year a large experimental deck panel was constructed in cooperation between the shipbuilders, Vickers-Armstrongs (Shipbuilders) Ltd, and Northern Aluminium.

The general construction method used for the panel was to join the plates by butt welds laid on to permanent backing bars wherever possible. Though experience of welded aluminum deckhouse construction was not as extensive as it is now, this system had already been successfully used for other ships. It was eventually adopted for the Oriana.

The welding itself was carried out with consumable-electrode argon-shielded-arc equipment. The widespread use of welding as a means of fabricating aluminum structures is comparatively recent, but the modern fluxless processes of this type are thoroughly established and have brought the same ease of construction in aluminum that the shipbuilder finds with steel.

Welding Equipment

Among the welding equipment used by Vickers-Armstrong for work in the Oriana was a quasi-arc gantry type machine (capable of Sigma welding of aluminum and Fusarc welding of steel) for fillet welding: quasi-arc tractor-mounted equipment for butt welding both in the shop and abroad the ship: and quasi-arc/B.O.C. Lynx sets for manually-operated assembly welding.



■ *One thousand tons of aluminum plate and sections were used in Oriana's all-welded deckhouse structure, much of which was prefabricated.*

Prefabrication was essential in the building of the aluminum superstructure. Deck panels 25 feet square and weighing about 2 tons were built up as units, and several larger structures such as internal stairways were also fabricated and lifted aboard complete.

As with a steel ship's structure, it is an advantage to use aluminum plates of the largest available size. Until recently, designers were hampered by the fact that at present there is no hot mill at work in England capable of supplying aluminum plates in widths greater than about 7 feet. To overcome this problem until its new wide rolling mill comes into operation next year, Northern Aluminium supplied for the Oriana and other applications Noral welded plate.

This is aluminum alloy plate of up to 11 feet wide, produced by the automatic welding together of two plates edge-to-edge in a special jig. The weld bead on the resulting composite plate can be ground flush, on both sides if necessary, making the finished plate comparable in appearance with ordinary rolled material.

The quality of the welding is such that for most purposes not involving forming the presence of the weld need hardly be considered.

Plate Finishing

To insure flatness, many of the pieces of Noral welded plate supplied for the Oriana were stretched after welding, using a 4000-ton stretcher recently installed at Noral's Rogerstone works. This huge machine, the only one of its kind in service in Europe, made a significant contribution to the success of the aluminum plate supply.

Similarly important was a 60-foot plate saw, in use at the same works, capable of cutting plates to a hitherto-unattainable degree of accuracy and with guaranteed edge straightness. By the use of this equipment it was possible to supply the aluminum plates cut to the exact required widths, thus minimizing the amount of shipyard plate trimming work.

The general thickness of the plates supplied was from 0.20 to 0.40 inch, with a small number of thicker plates. All were of aluminum alloy to the B.S.

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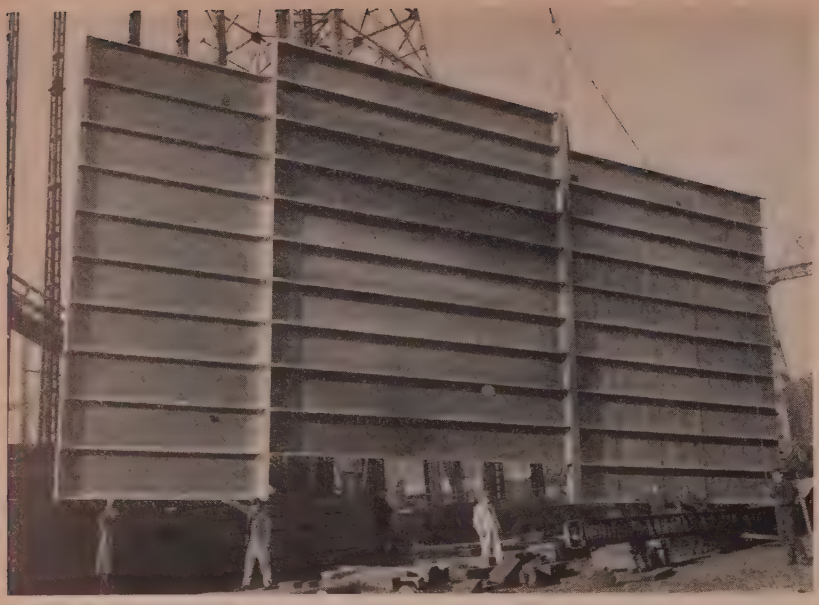

■ *This experimental deck panel figured in preliminary tests to discover the best welding procedure for Oriana's aluminum superstructure.*

NP5/6 specification, meeting the requirements of Lloyd's Register for welded ship structures.

Extruded Sections

As far as possible, extruded aluminum alloy sections were used in the Oriana's superstructure for girders and other members, as well as for deck beams and stiffeners, rather than members fabricated from plate. This has meant that the proportion of extruded sections in the structure is higher than is usually the case in work of this kind.

The sections throughout were of aluminum alloy to the B.S. NE6 specification, again meeting the requirements of Lloyd's Register. Some unusually large extrusions were included—up to 16 inches in overall dimension and with a weight of over 15 pounds per foot. For beams and stiffeners incorporated in the prefabricated deckhouse panels, a special series of sections with a tapered bulb was used as an alternative to the better-known square-bulbed British Standard aluminum shipbuilding sections.

The building of a ship with this 1000-ton aluminum superstructure—by far the largest welded aluminum structure ever built—not only indicates the progressive outlook of those responsible for its design, but also demonstrates the great progress made in the development of sound techniques for the employment of welded aluminum in shipbuilding.

Less than ten years ago a shipyard application of aluminum on the scale of that in the Oriana would have hardly been predictable. The advances made, particularly in the welding of aluminum, to which the Aluminium Limited group of companies have made a major contribution, have undoubtedly surpassed all the expectations of a few years ago.

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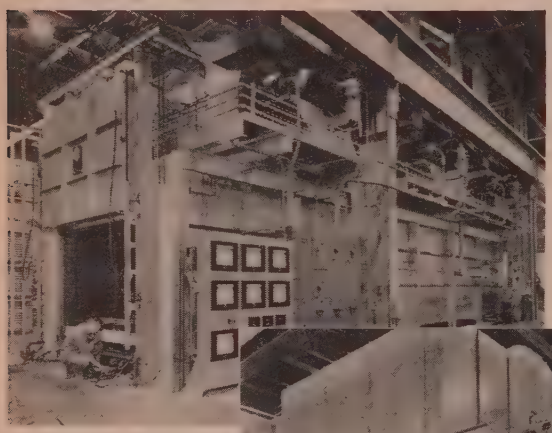

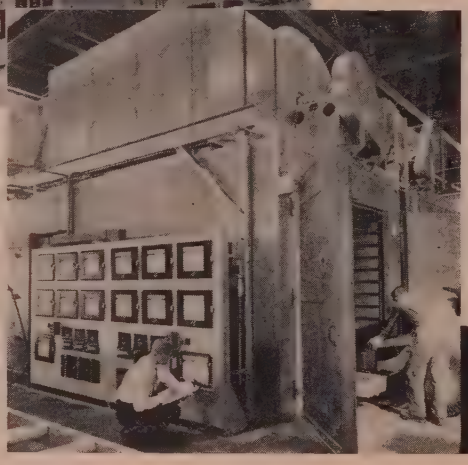

Radiant tube furnace for annealing aluminum straight tubes up to 50' long, 2" tubing in 48" diameter coils and extrusions of various shapes and lengths.

•

Right—Car type ovens for aging aluminum sheet up to 6' 6" wide x 32' long, tubes up to 6" O.D. x 50' long and extrusions up to 16" cross section x 50' long.

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But we had to build a plant here to do it.

It's already in operation at Rockville, Conn. Continuous anodizing and dyeing equipment is producing ANO-COIL by the same fully automatic process that distinguished the quality of the imported product. Color uniformity and finish are electronically controlled throughout the coil. A wide variety of embossed and perforated patterns is being made.

Now, all the sales appeal and production economy of this color anodized aluminum strip are within easy reach. Advantages like—

Pre-finished coils permit continuous automatic feeding.

Coating is flexible for roll forming and shallow drawing.

Finishing after fabrication is completely eliminated.

Anodized coating won't tarnish. No lacquer overcoating is needed to preserve its brilliance.

Color is consistent—no matching problems.

No electrode marks, hence no waste to cut away.

Savings—often as much as 50%—over conventional dip-by-batch methods.

ANO-COIL is currently being used for such diverse products as decorative trim, buttons, name plates, wall tiles, weather stripping, molded knob inserts and roll-formed tubing, furniture moldings and trim, to name but a few. Applications are limited only by your imagination.

If you've never used aluminum before, ANO-COIL may be the best thing that could happen to your product. If you are using aluminum now, ANO-COIL may well put you on the road to a more efficient, more profitable operation. Send for samples and see.

ANO-COIL strip will now be available in standard colors including gold and brass, in commercial size coil widths up to 24".

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CONTROLLING High Purity Aluminum MELTING

Special furnaces last longer, need less care, give more economical melting, and don't impair quality of the charge.

By R. D. Coen, General Electric Co. Fort Wayne, Ind.

IN THE electrical motor industry we are vitally concerned with the subject of melting aluminum. It is a critical operation because the aluminum is cast as the electrical windings in the rotors of our motors.

Close control of quality is essential. The purity of the purchased aluminum is 99.9%, leaving only .4% maximum allowed for impurities. These impurities include silicon or silica oxide.

Silica oxide is also a major ingredient in furnace refractories. When a refractory comes in contact with molten aluminum, the silica in the refractory will transfer to the aluminum as silicon. Result: The aluminum loses its purity.

Realizing this problem, and also considering the economics of the melting operation, we launched an investigation to find a better method of melting aluminum. A preliminary comparison of electricity and gas showed that gas was more economical, but previous experience showed that operator comfort was impaired when gas was used. However, we felt that this problem could be lessened by cutting down the losses of the furnace.

We contacted several manufacturers of gas fired industrial furnaces, and after studying what each had to offer it was decided that the furnace offered by Selas Corp. of America, Dresher, Pa., would suit our purposes best.

Selas then proceeded to build an experimental furnace on the assurance from refractory manufacturers that there would be no transfer of silica to the aluminum when using a refactory containing 90% alumina and 8% silica.

Fuel Mixtures Closely Controlled

This furnace is a two-section dry hearth design with a holding capacity of 400 pounds and a melting capacity of 300 pounds per hour. Both sections of the furnace are roof-fired with Duradiant burners, which create radiant heat by burning closely controlled gas-air mixtures against special cup-shaped refractory surfaces (see diagram). The cup surfaces, in turn, beam this radiant heat to the aluminum.

Greater speed in the melting of aluminum is being achieved by a combination of this controlled rate of heat transfer and close proximity of the heat source to the aluminum. Such proximity is possible because there is no flame impingement that would contaminate the aluminum, combustion being completed entirely within each refractory cup.

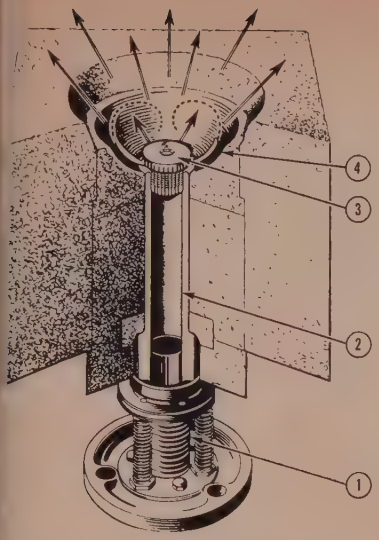
The furnace was delivered and installed in our plant, put into operation, and charged with high purity aluminum of known composition. After three days a sample was taken from the holding bath and checked by spectrographic analysis.

It was apparent that the silicon content had risen sharply—from .07% to .24% by weight, which is over the allowable maximum of .11% for a rotor casting. Realizing that the furnace lining was inadequate, the refractory manufacturers were contacted and they offered 99% alumina refractory.

We then ran a severe accelerated trial on this refractory by submerging a sample of it in molten aluminum and measuring the silicon pickup in the aluminum. Factors considered were (1) volume of aluminum; (2) area of submerged refractory; (3) temperature; (4) length of time of trial.

These trials showed a slower leeching

Two views of Selas furnace designed specifically for melting high purity aluminum used in casting rotors for electric motors. At left, operator is loading 50-pound aluminum ingots into dry hearth section of furnace. At right, operator is dipping molten aluminum from dip well on opposite side of furnace, which melts 300 pounds per hour, holds 400 pounds of molten aluminum. Refractory is given high temperature treatment to prevent contamination of metal.



■ *Diagram of Duradiant burner operation showing flexible mounting (1) of burner tube, which permits burner to adjust to wall expansion. In operation, gas-air mixture enters tube (2); moves to burner tip (3); passes through tip and burns radially on refractory cup surface (4).*

ate for the 99% alumina refractory, ut it was still prohibitively high. Also, his refractory showed inadequate me-hanical properties after the trial. Car-ide refractories were also tested in hese trials.

Selas then suggested a new treatment or furnaces handling high purity alu-ninum. This involved an elevated tem-erature surface treatment that would nlarge the pores of the refractory. The reatment should extend above the ontemplated bath level of the alumi-ium to get complete protection. It is ot necessary to treat the hearth be-ause the liquid aluminum is not on he hearth long enough to absorb im-urities.

After this treatment we checked the esults. It was found that silicon ab-orption was stopped and the melted luminum actually showed improve-nent after three days in the bath, due o a purifying action. This treatment as been given to two of the three addi-ional Selas melting furnaces supplied o G. E. for melting high purity alu-ninum.

Advantages of Furnace

This furnace then was put into the roduction line and its performance has een checked periodically. These checks ave always showed favorable results, ven after two years of production use.

Some of the advantages of this fur-ace include:

1. No contamination of the alumi-um.

2. Minimum oxide in the aluminum bath because oxides in the ingots or pigs are left on the hearth.

3. Small amount of aluminum in the bath and fast turnover (furnace holds 400 pounds in the bath, and melts 300 pounds per hour).

4. Fluxing of the bath is eliminated because the oxides are kept out and the refractory is sealed against leeching.

5. Fifty pound pigs can be used because they are not submerged in the bath.

6. Preheating of ingots or pigs outside the furnace is eliminated because of the dry hearth system.

7. Lower investment cost than electric system.

8. Lower fuel cost in our area.

9. Lower maintenance costs due to simplicity of furnace and controls.

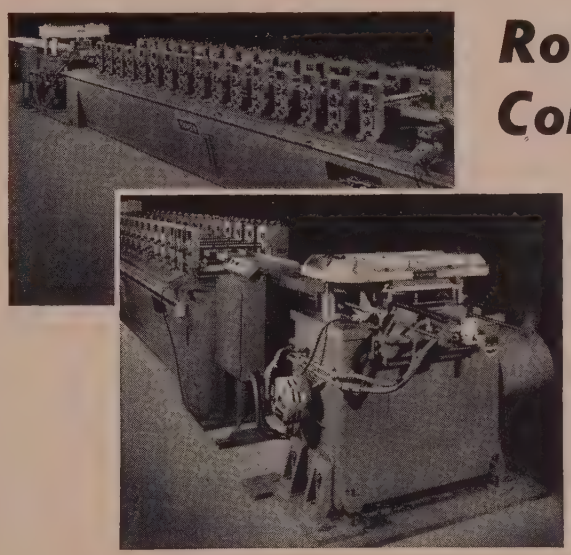
10. Lower installation cost.

11. Longer furnace lining life.

12. Less downtime for maintenance because the furnace does not require fluxing or rodding of channels.

13. Less surveillance required during weekends (if the fuel supply fails the furnace can freeze without harm).

As can be seen from this information, the advantages of this system of melting high purity aluminum cannot be ignored in this cost-conscious economy.



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Looks like record year for aluminum

► Autos, appliances, packaging, transportation, electrical manufacturing, and other major industries anticipate substantial gains this year. Most of them adopted aluminum for new applications in 1959 which should serve to boost total consumption in '60. Even a lagging home building industry is expected to contribute to greater consumption through increased sales of prefabricated aluminum homes.

By **K. B. Rhodie, Associate Editor**

ALUMINUM will soar higher in 1960 than it has at any other time since the industry started its postwar boom. The economic prophets of the primary producers say this first year of the new decade will see aluminum consumption rise 10 to 15% above 1959's mark—a record-breaking 17% above the previous peak established in 1956.

Optimistic views are also held by the U. S. Department of Commerce, associations connected with the aluminum industry, and various other sages. The business outlook in general looks bright, according to those who appear to be in the know, which further indicates a booming aluminum year.

Such industries as automotive, construction, appliances and electronics are gearing up for record production and sales. An all-time high steel output is predicted for 1960, as is more employment—which will lead to a large consuming public with plenty of funds available to satisfy its needs and desires.

Statistics compiled by the U. S. Department of Commerce, Aluminum and Magnesium Division, show that the aluminum upswing which started in late 1958 and continued through 1959 will give impetus to a real boom year in 1960.

The division estimates that about 2,450,000 tons of aluminum were shipped last year, representing a 37% increase over 1958. Primary production increased 25% to an estimated 1,950,000 tons. The industry's installed capacity was rated at 2,336,000 tons, having been upped 141,500 tons during the year.

Shipments of all types of mill products increased, too, though final figures are not yet available. For the first 10 months, mill products increased 33.7%, with individual increases ranging from 2.3% for extruded shapes in 2000 and 7000 series, to 71.2% in welded tube. Total shipments of castings for the first three quarters increased 40.4%, with permanent mold castings showing a 61% rise.

An important factor influencing the increased aluminum business in 1959 is the increase in research and development facilities, and of production capacity of primary metal and semi-fabricated shapes. Other facets include development of new alloys; an auto manufacturer starting what is hoped to be a trend toward aluminum engines; large amounts of aluminum being used in home construction; acceptance of aluminum cans; new military applications; and aluminum's increased use by the railroad industry.

10 to 15% Improvement

Barring major setbacks, such as strikes in key industries, all indicators point toward continued rapid growth of the aluminum industry. The Department of Commerce says this growth "is expected to be from 2 to 2½ times the improvement expected in general industrial production. . . . A reasonable expectation is for a 10 to 15% improvement in 1960 shipments to consumers."

Auto makers will use 13 to 15% more aluminum per car this year than last. A 22% increase in domestic production of autos is anticipated, which would result in about a 40% increase in aluminum used by the industry.

Housing starts will dip in 1960, but much more aluminum will be used by this industry. Sales of aluminum building products soared 40% last year, and additional increases are expected this year.

Evidence to support such optimism, in the face of decreased housing starts, is statistics offered by a Reynolds Metals Co. spokesman. According to David P. Reynolds, executive vice president, an estimated 500 homes of aluminum exteriors were constructed in 1958. But, approximately 15,000 such homes were started last year. Statistics may indicate fewer housing starts in 1960, but they also point to a greatly expanded number of homes using aluminum exteriors and accessories made of the light metal.

Other increases are expected in the appliance industry and other consumer durables, equipment and machinery, foil packaging, and aluminum cans. More aluminum will be used for deoxidizing steel and for alloying. Aircraft programs call for less aluminum, but missiles are expected to use more.

Though many fabricators have large inventories, built up when it looked as though aluminum workers might strike, it is expected that new uses for the light metal will boost shipments. Anticipating this, aluminum producers will increase capacity another 269,000 tons by the end of 1961.

Aluminum: Up

The aluminum producers we have heard from make similar predictions for the year. Alcoa President Frank L. Magee says that though shipments will rise 10 to 15%, actual aluminum consumption will be even higher because metal will be used that has already been shipped to users. He also foresees a "corrective strengthening of world prices in 1960, as the general economy improves both here and abroad."

Alcoa is preparing for aluminum's bright future. Construction of its $30-million research and development center in Merwin, Pa., is slated to begin late this year; the new 150,000-ton smelter at Warrick, Ind., is being brought to the point where it can oper-

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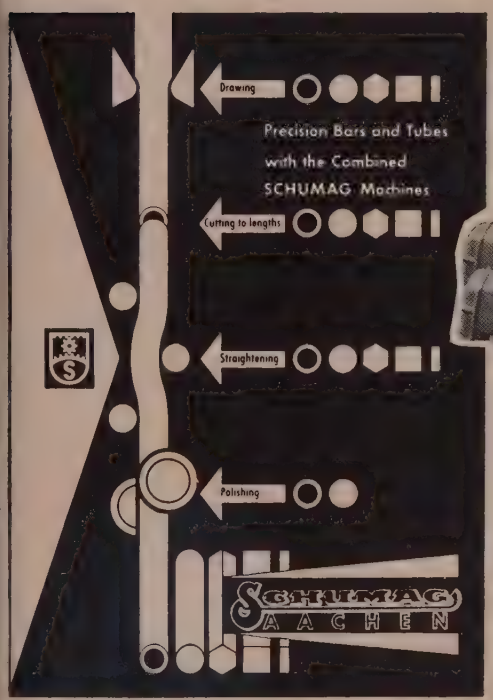

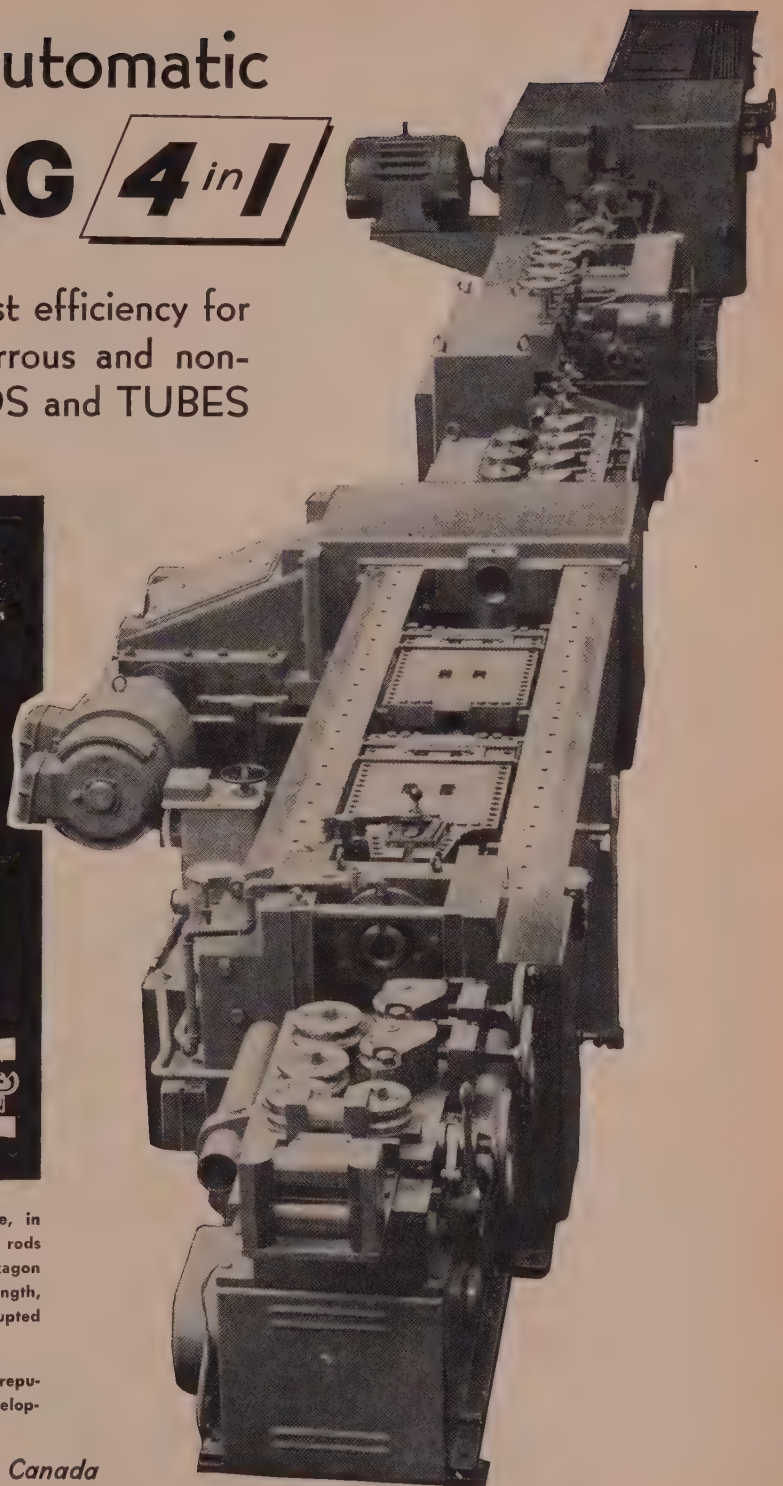

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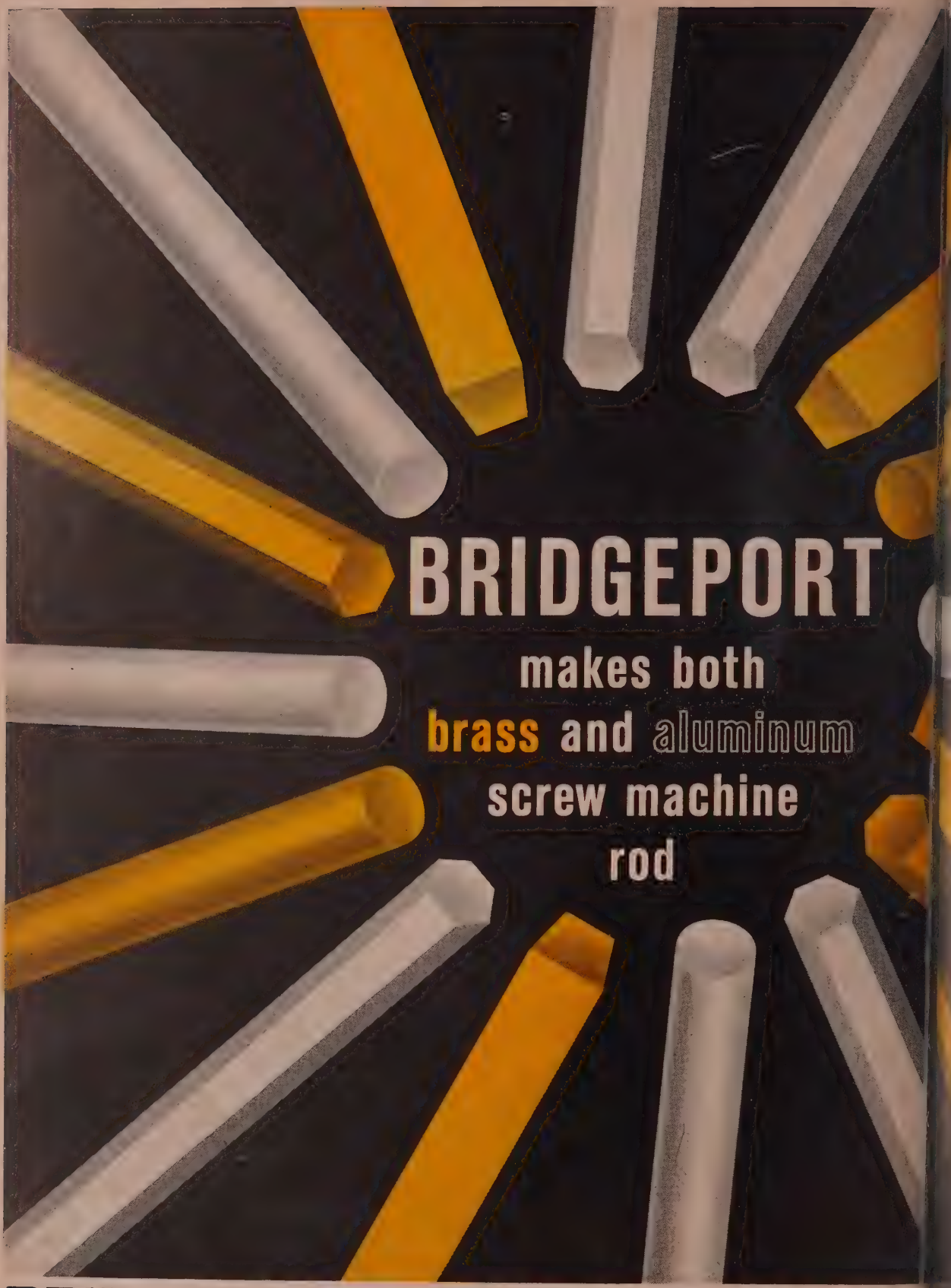
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SIZES	Diameters in 1/64" increments from 1/2" to 3" in standard 12-foot lengths.
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Advantages: highest machinability of all—lowest tool wear of all; easiest attainable and most beautiful finish; best corrosion and rust resistance; *highest scrap value.*

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SIZES	Diameters from 1/16" through 4-1/2".
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ate at short notice; and a new die casting plant is being completed at Edison Township, N. J.

R. S. Reynolds, Jr., president of Reynolds Metals Co., says that "all aluminum products are priced too low, considering increased costs of labor, materials and capital." An example of this was the price of pig until mid-December, when it stood 1.3 cents below 1958 prices. But the late-December increase brought the price back to 26 cents a pound as it stood before April '58 reduction.

The price increase, and the optimistic predictions for 1960, have touched off speculation about another increase in the near future. Some producers want a 7/10-cent a pound hike. As one executive recently put it:

"To build new markets you need higher prices to underwrite bigger research and development programs; but if your prices go too high, you defeat your own purpose."

Reynolds says that architectural and building products markets will use 700,000 tons of aluminum this year, following last year's 30% increase to 600,000 tons. Another giant industry, railroading, is expected to make more use of aluminum. Already in production are aluminum hopper and gondola cars, with aluminum box cars a possibility.

Aluminum foil strip conductor will be used in more than 1 million horn coils in this year's cars. Members of Reynolds' higher echelon predict that in three years every U. S. auto maker will have a line of aluminum engines. Aluminum will also register gains in highway bridge construction and substations and towers for electrical utilities.

. . . And Up

Prospects for vigorous growth in aluminum sales during 1960 are excellent in virtually every marketing area, according to Derek Richardson, vice president of aluminum sales, Metals Division, Olin Mathieson Chemical Corp.

The coming year will "bring substantial gains in the automotive, container and electrical industries, and in the building trades," he explained. "Even if housing starts are reduced from 1959 levels, construction with aluminum will increase because of expanded consumer acceptance plus new product developments in roofing, siding, interior partitions, radiant heating panels and a host of other applications."

Richardson expects new outlets to develop from the recent advances in adhesive bonding of sheet and in surface-finishing techniques such as continuous porcelainizing of aluminum coils. He thinks that adhesive bonding, combined with inert gas welding in some cases, will offer designers much leeway in producing boat hulls, automotive assemblies, truck-trailer bodies, electrical appliances, etc.

Eric F. West, president of Aluminium Limited Sales, Inc., also foresees great things for aluminum. The parent company, Aluminium Limited, is making plans to increase its potential primary capacity to 1 million tons a year. This is being done by adding 1 million h.p. of hydro-electric power and increasing its bauxite facilities in the Caribbean.

This company looked to railroads as potential users long ago and pioneered development of aluminum box cars, welded aluminum covered hopper cars, and aluminum refrigerator cars. The hopper cars, eight tons lighter than their steel counterparts, have been accepted by the Association of American Railroads for interchange on U. S. railroads.

Conservative View

Kaiser Aluminum & Chemical Corp.'s president, D. A. Rhoades, agrees that the industry is in for a good year, but is somewhat more conservative in his forecast. He sees the production of primary aluminum in 1960 "ranging from 7 to 10% above present levels."

Carl Burton, secretary of the Aluminum Smelters Research Intstitute, estimates production of smelters' aluminum alloys for 1959 at 350,000 tons. Burton sees a good year for smelters in 1960, with output reaching 400,000 tons of alloy ingot using 500,000 tons of scrap. During the sixties he expects production to rise to 750,000 tons.

The world aluminum picture also looks bright. Norway drew even with West Germany as an aluminum producer, turning out 145,000 metric tons last year. France is still the largest European producer, but Norway expects to pass it in a few years when projects under construction will boost output to 230,000 tons a year. Japan and France report demand for the light metal is outpacing supply.

Further support of the contention that 1960 will be a boom year for aluminum are the predictions that business in general will thrive. Paul W. McCracken, one-time member of President Eisenhower's Council of Economic Advisers, sees the total national output of goods and services in 1960 jumping $30 billion over 1959, to $510 billion.

McCracken, a University of Michigan professor, has some reservations about his crystal-balling. He says excessive price increases and shortage of credit could inhibit business growth.

Dr. Arthur F. Burns, president of the National Bureau of Economic Research and former council chairman recently commented that current business trends indicate milder future recessions. But, he added, his forecast could be complicated by fast-rising prices.

Consensus of economists at the recent Conference on the Economic Outlook at the University of Michigan, favors a strong first half, with some predicting a leveling off for the final half, and others looking for a slight decline. Patrick J. Crane, market analyst for General Electric Co., says there is the possibility of a drop in the second half "because there will be a tendency to overbuild a bit early in the year."

Some economists think business will be on the rise all year, but the majority say that by July most steel inventories will be replenished, and that a backslide is inevitable.

Albert T. Sommers, director of the Division of Business Analysis of the National Industrial Conference Board thinks 1960 will be a good year from one end of the calendar to the other. His remarks to the American Dental Trade Association in Chicago, however, were not without warning.

"Whereas late 1960 was formerly considered a candidate for a possible downturn in business conditions, it is now widely expected to be a period of high activity, perhaps accompanied by speculative excesses and rising prices."

But, he added, "the distortion of normal business trends resulting from the (steel) strike, and the atmosphere of shortages and scarcities arising out of the strike, could well make business highly sensitive to recessionary influences by early 1961 and leave open the possibility of serious recession at that time."

Purchasers Keen for '60

The National Association of Purchasing Agents surveyed its members in December and found that 68% of those polled feel business in the first half will top 1959. Only 2% look for a drop, while 30% forsee no change. For the entire year, 75% see better business ahead, 2% look for a decline, while the remaining 23% expect no change.

One major revelation of the survey was the difficulty plants were having at the time in getting enough steel to meet production demands. This undoubtedly colored predictions, and those surveyed might be more optimistic now that steel's dispute has been settled.

More optimism seeps from representatives of three of the nation's industrial giants. According to Frederic Donner, president of General Motors, "1960 will be a good year for business generally." He looks for 8 million cars and trucks to be sold.

Frederick Kappel, president of Ameri- Telegraph & Telephone Co., says Bell System is looking forward to 60 as a year of "continuing growth." gene Holman, chairman of Standard Co. (New Jersey), anticipates in- ased oil demand.

l Set to Spend

Other phases of the national economy ok just as good. Employment will be ; with Labor Secretary Mitchell pre- cting that total workers will reach new high. With employment on the e, the steel strike settled, and 1960 ospects excellent, the American buy- g public is set to spend its money, ich will further buoy the nation's nomy.

The *Wall Street Journal* thinks that e spending intentions of American nilies "point to a continuation in 60 of the buying surge that marked t year's retailing picture. In fact, an en greater buying binge seems in ospect."

A Conference Board survey indicates at "plans to purchase automobiles, th new and used, (are) significantly gher than a year ago. Plans to pur- ase many household appliances still int upwards, while purchasing plans r new homes (are) holding firm."

Arthur Rosenbaum, manager of eco- mic research for Sears, Roebuck and ., sees consumer income 5 to 6% gher this year than last. *Business Week* edicts consumers will "increase their ending by something like $7-billion each of the year's first two quarters."

eel & Construction

Steel mills will operate at between and 90% of capacity while consumers uild up depleted inventories, accord- g to reports from U. S. Steel and reat Lakes Steel Corp. The industry xpects ingot output to hit 128 million ns, topping record output of 117,036, 85 tons in 1955. Record output of eel would very likely lead to the same r consumption. And the more steel sed by large manufacturing industries e more aluminum used.

Though top executives in Detroit say million cars will be sold this year, ther analysts from the Motor City redict something less—between 6.3 nd 6.7 million units, including im- orts. More aluminum is being used by he industry, however, with new cars mploying an average 56.2 pounds com- ared to 49.6 in 1959.

The construction industry in general s expected to increase its total volume uring 1960, though private home starts hould dip slightly. This will be main- y due to difficulty in getting mortgages, nd higher interest rates.

(Continued on page 86)

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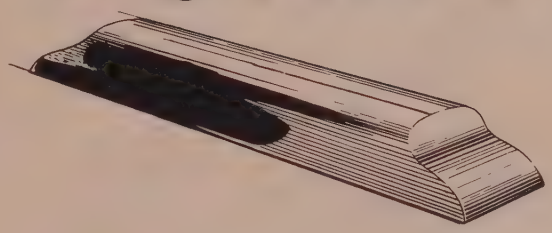

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Saul B. Klaman, director of research for the National Association of Mutual Savings Banks, predicts a 15% drop in housing starts from 1959, to 1.2 million units. F. W. Dodge Corp. was more conservative, saying starts will drop only 10%. The National Association of Home Builders, at a recent meeting, said that private home construction might drop as low as 1.1 million starts in '60.

Dodge also sees an optimistic side to the 1960 construction story. It says that total contracts for the year will reach their second highest peak. "Practically every construction category other than housing should show gains over 1959."

Total Contacts Up

The biggest increase, 7%, is expected for non-residential construction—plants, commercial buildings, schools, hospitals, churches. A 2% rise is predicted for heavy engineering structures, including roads, dams, utilities and airports.

William F. Butler, vice president of economic research for the Chase Manhattan Bank boosts this claim: "I think we are in for an upward move in business expenditure for new plants and equipment that could extend through 1960, and perhaps through 1961 as well."

C. S. Nelson, vice president of the Continental Illinois Bank, predicts a federal cutback in road building, but foresees rising outlays for new plant and equipment, picking up the slack in other construction areas.

Approximately 147,000 mobile homes and trailers were manufactured in 1959, accounting for 12% of the country's new housing starts. It is estimated that mobile homes will represent 14% of starts in 1960.

Appliances

Near record sales are expected by the appliance industry to get the sixties off to a good start. A General Electric spokesman looks for a 6 to 8% increase, while Chris Witting, vice president and general manager of Westinghouse's consumer products group looks for major appliances to "move up slightly again in 1960, perhaps to a new high."

The National Electrical Manufacturers Association reports that shipments of major electrical appliances were up 17% in 1959, to the highest total since 1950. Four appliances made individual record gains, with built-in ranges taking the biggest leap, 38%, and freezers the smallest, 9% above last year, and 5% above the record-year of 1952.

NEMA predicts its industry will increase 1960 shipments by 3%, with individual items making the following gains:

	1959	1960
Refrigerators	3,750,000	3,800,000
Ranges	1,680,000	1,750,000
Water heaters	740,000	750,000
Dishwashers	525,000	575,000
Food disposals	785,000	825,000

The electronics industry made major strides in 1959, and will continue to do so, according to predictions of David Sarnoff, chairman of RCA, and David Hull, vice president of Raytheon Co., and president of the Electronic Industries Association.

Sarnoff foresees 1960 as a $16-billion year for electronics and envisions a $25-billion year by 1965. "Such a rate of expansion would make electronics the nation's fastest growing major industry," he declared.

Electronics

Hull looks for great things to spur electronic sales to the government and big industry, as well as to the American public.

He says government uses will expand as the shift from manned aircraft to missiles proceeds. Missiles require far more electronic controls than conventional craft. Non-military uses will also grow. "There will be a tremendous number of satellites in space for such purposes as worldwide television, weather reports, and very advanced global communications."

Industrial applications will rise sharply as factories and offices turn more and more to automation, predicts Hull.

For the mass consuming public, sales will be sparked by the introduction of electronic cooking ranges and stereophonic radios. Both are in the offing, with the radios waiting for performance standards to be set.

Aircraft manufacturers are heading for cutbacks which will reduce the amount of aluminum used by this industry. However, the government's increased reliance on missiles and rockets will demand more of the light metal.

In an effort to stay within a $41-billion military budget, the administration has cut aircraft contracts. Recently, an order for 96 KC-135 refueling tankers was slashed to 66; an order for 32 B-58 Hustler bombers was dropped to 20; and the full-scale production of the B-70 supersonic craft was reduced to two test planes.

Piper Aircraft Co., manufacturer of light commercial planes, set sales records in 1959, and looks to 1960 with great anticipation. Introduction of two new models is expected to aid sales.

While the government is cutting back plant contracts, missile agreements are rising. The Atlas, Titan and Minuteman programs, all long-range missiles, will be expanded by mid-year.

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MAN of the YEAR: William K. Coors

His Beer Cans Helped Aluminum Crash the 42 Billion Can Market

After four years of intensive development and an investment of $1 million, Coors and his associates came up with an impact extruded aluminum beer can that actually cost less than a similar can in tin plate. This accomplishment, the first successful aluminum captive can operation in the U. S., dramatizes aluminum's impending invasion of one of the biggest potential markets.

By F. L. Church, Senior Editor

PRIOR to the Civil War, the preservation of food was essentially a household enterprise based on such primitive methods as salting, pickling, drying and smoking. Mechanical refrigeration was scarcely envisioned, and even the use of natural ice was limited by the plodding transportation of the time.

Although the commercial canning of food had been tried in Boston as early as 1821, and actually used on a small scale in Baltimore in the 1840's, it took the military logistics of the War Between the States to give this all-important process its first great impetus.

The postwar growth of the canning industry quickly gained momentum, stimulated by the emerging mass markets in the cities, and aided by great strides in food chemistry and the declining cost of glass and metal containers. By the end of World War I, canned products accounted for about one-quarter of all sales of fruits and vegetables in the U. S.

Here was a revolution of the first magnitude. Within a few decades, the ubiquitous can of peas had become a symbol of new economic order created by science, technology and sweeping social changes.

Only the Beginning

But this was only the beginning. The nation's population continued to both "explode" and gravitate toward the cities. An agrarian economy was being transformed, seemingly overnight, into an industrial society in which relatively few families could produce their own food.

The need for preserved and conveniently packaged foods multiplied at an accelerating rate. The canning industry kept pace, aided by improvements in containers, more efficient filling and handling techniques, and swifter means of distribution.

5 Million Tons of Steel

Today, the manufacture of cans is an enormous industrial complex that employs many thousands of workers, consumes millions of tons of materials, and produces billions of metal containers for packaging everything from foods, beverages and cosmetics to insecticides, paints and motor oil.

Although several metals were tried during the early days of commercial canning, steel eventually took over because of its low cost, availability, and favorable mechanical properties. Today, the can market consumes approximately 5 million tons of steel annually.

But steel is readily attacked by most foods and other products; it needs a coating of some inert material. Tin got the nod mainly because of its chemical properties and the relative ease with which it could be applied to steel by hot dipping. Later, the electrolytic tinning process was adopted to conserve this costly material. Today, electrolytic tin plate is the standard can material.

The familiar tin can is doing an adequate job in most applications, but can makers and can users alike realize that there is room for improvement in containers in general; that total dependence upon one material could prove hazardous at a time when virtually all tin comes from foreign sources.

This, plus several years' successful use of aluminum cans in Europe, explains the recent flurry of interest in aluminum as a substitute for tin plate in cans. The aluminum producers, their appetites whetted by the profitable success of foil in other fields of packaging, have poured millions of dollars into aluminum can research and development. The big can makers have grudgingly admitted that they have been working on aluminum cans for several years.

Coors Pointed the Way

But it took a relatively small company — one that had produced neither aluminum nor cans — to come up with the first successful captive aluminum can operation in the U. S. It was just one year ago that the Adolph Coors Co., a brewery in Golden, Colo., publicly unveiled an integrated facility that produces competitively priced aluminum cans for packaging beer.

The Coors development is significant, not for the number of aluminum cans produced — which is small, even compared with the number of steel cans used by Coors itself — but because it proved that the aluminum can is both technologically feasible and economically practical in the U. S. The fact that the company accomplished this with its modest resources and limited experience with aluminum is a tribute to both William K. Coors, president of the brewery, and the small staff of technicians who made the process work.

For these reasons, plus the fact that the Coors development has dramatized the burgeoning use of aluminum in

s, Modern Metals has selected Bill rs as "Man of the Year" in the light als industry in 1959.

hy Aluminum Over Steel?

Of the many factors that stimulated ors' initial interest in aluminum cans, haps the most important concerned company's marketing area, the chem- l reaction between beer and tin plate, ll the problem of disposing of used er cans.

"We sell our beer in a sparsely settled a covering almost half of the U.S., t containing less than 10% of the pulation," Bill Coors explains. "Rapid nover is especially difficult for us, so are possibly more concerned about e shelf life of our beer than is the erage brewer. And much of our trade a is in the hot southwest where tem- rature aggravates the shelf-life prob- n.

"Another peculiarity of our market is e marked preference for canned beer; % of our packaged beer goes out in ns. That's roughly double the industry erage."

Noting that both tin and iron ay be unfriendly to beer, and that ve have yet to see a can interior so rotectively coated that the beer will not ick up tin and iron as it sits on the elf," Coors points out that "the alu- inum can largely overcomes these ortcomings of the tin can."

Coors, like other brewers, is deeply oncerned about what happens to used eer cans. All too often they end up on ie highway or littering the park or each. Organizations that favor the re- urn of prohibition take particular de- ght in blaming brewers for the litter. oors reasoned that an aluminum can ight have sufficient scrap value to en- ourage consumers to return the cans or cash.

"Any one of these reasons was sufficient to whet our interest when, back in 1954, a Mr. Louis Bronstein came to us with the basic concept of an aluminum can for beer. . . . He had no patents, no licenses, no secrets, and had already been turned down by two major American breweries."

But Bill Coors *was* interested. So was his close friend, Brown Cannon, vice president of Beatrice Foods Co., the big Chicago-based food processor whose small brewery in Hawaii couldn't get the cans it desperately needed to cope with the mounting competition from mainland breweries.

With Bronstein as his informed and resourceful guide, Bill Coors made a five-week tour of the appropriate aluminum fabricating plants in Europe—mostly Germany—and came back convinced that the aluminum can had intriguing possibilities.

"Started from Scratch"

He talked his associates into giving it a try, and in 1955 Coors and Beatrice Foods joined forces with Bronstein to form Aluminum International, Inc. Purpose: To develop a facility that would produce aluminum cans efficiently.

"We started from scratch," Coors recalls. "First we had to decide on a process. There are many ways to make an aluminum can. If necessary you could simply machine it out of a block of metal. The trick is to produce the can at a price that compares favorably with that of tin plate cans.

"Contrary to the advice of aluminum experts, we decided on impact extrusion. We have since learned that other processes were further along in development at that time, but interest in impact extrusion seems to be on the upturn now."

The starting point for impact extrusion is a slug of aluminum about the same diameter as the can to be produced and about ⅛-inch thick. Aluminum International could have bought slugs on the open market, "but five years ago the going price for slugs was just about equal to what we had to make the whole can for. So our first really tough job was to work out a low cost method of making our own slugs."

Three years of painstaking development finally created an efficient continuous casting, rolling and slug blanking installation that broke the cost barrier. Though crude in appearance it was so successful that, in Bill Coors' words, "when some of the large aluminum producers and fabricators woke up to what we were doing they dropped the price of slugs so low that we could now buy them for less than we can make them."

The low cost slug, he adds, "puts the impact extruded can well within the reach of anyone who wants to jump in."

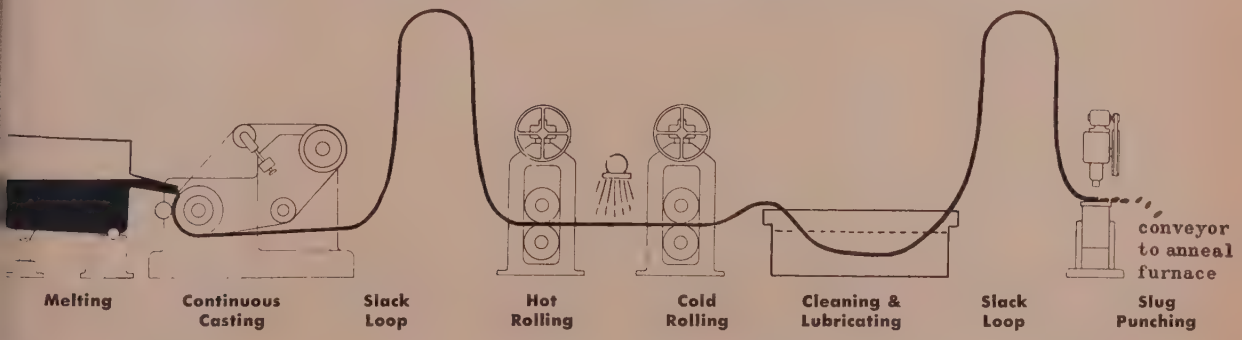
Aluminum International's development team encountered similar problems with can lids. The first price quote from an outside supplier nearly equalled the combined cost of can and lid that Coors was aiming for. Later bids were still about 50% too high "so we soon found ourselves rolling our own aluminum strip down to proper gage for lids and punching them out ourselves."

Difficult as these problems were, they proved to be only the beginning. Most of the equipment the company had purchased was from Europe, and required considerable human attention. Since high wage rates in the U. S. would push the cost of operation to prohibitive levels, the machines had to be revamped to run with a minimum of manpower.

Keep Labor Cost Low

"I watched a complete can line in Germany five years ago, using basically the same machinery we have," Coors explains. "It was putting out 6-ounce

Material Flow in Continuous Casting, Rolling, Blanking Line at Coors Can Plant



■ *Simplified drawing shows major operations of continuous casting, rolling and slug blanking line at Coors can plant. Melting and casting are actually on higher level than rest of line. Slack loops serve as accumulators to keep line flow uniform. Cast bar starts out 6.5 inches wide and .700-inch thick; ends up same width but .125-inch thick when it leaves cold rolling mill. Conversion cost could be cut to 3 cents a pound by boosting casting rate to 5000 pounds an hour.*

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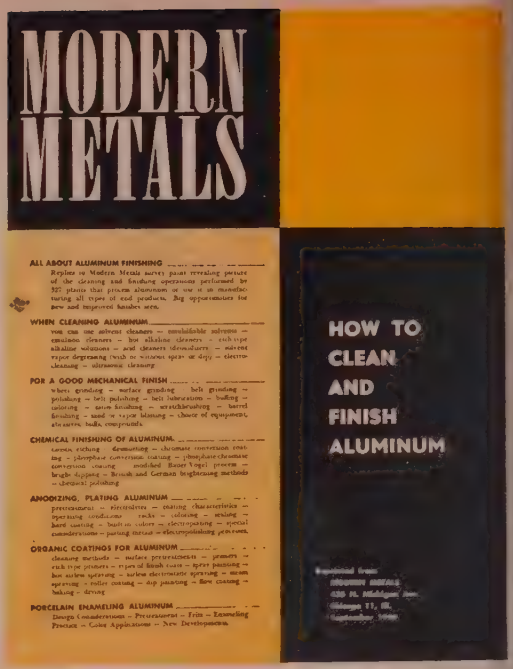

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cans at 40 per minute with the assistance of at least 12 people, each receiving about 24 cents an hour for his trouble. Our prototype line runs almost three times as fast with a maximum of five people, and we should be able to hold the manpower at this level as the speed goes up."

Coors quickly adds that the German can plant probably would have been scaled up "to equal ours in efficiency" if they had to pay American wages.

Productive Prototype

The actual production sequence is interesting enough to merit a brief tour of the can plant, which is located in a small building adjacent to Coors Porcelain Co., another family-owned firm situated several blocks from the brewery. Coors and his associates consider the can plant a prototype line, but it has delivered more than 14 million cans and lids to the brewery in its first year of operation.

At the starting point, 50-pound pigs of 1100 alloy are melted in a 450-KW Ajax-Magnethermic low frequency induction furnace. Melting capacity of this unit is 2000 pounds of aluminum per hour; holding capacity is 6000 pounds.

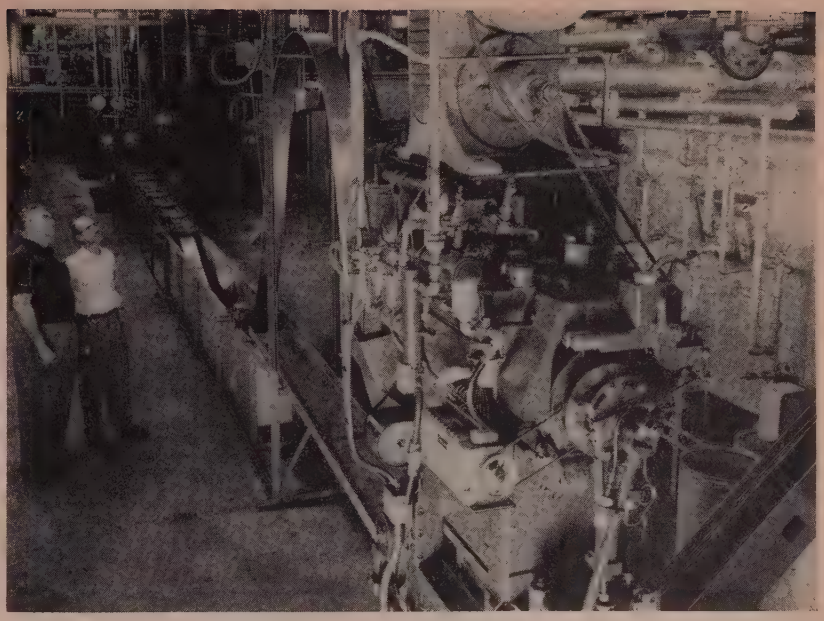
"We melt on the average of five to six tons per shift," shouts Jack Porterfield, can department manager and chief engineer of Aluminum International. "With two shifts a day and a five-day work week, we manage to put away anywhere from 50 to 60 tons of aluminum per week. Occasionally we've had to push her to eight tons per shift, but that doesn't happen often."

In the quiet of his office, Porterfield later confided that the melting furnace has run continuously since October, 1955 without having its lining changed. "We've replaced the inductors only once, and we clean out the channels once a day. We melt our own scrap in addition to pig, but that's no problem."

Back at the casting line, the metal is melted and held at 1280-1320°F and fed across a launder to the continuous casting machine, which operates on the wheel principle similar to that used by the Properzi process. A continuous mold is formed between the machined channel in the revolving wheel and a continuously moving endless steel belt. Both the wheel and the belt are water-cooled.

As molten metal flows down through a specially designed spout into this water-cooled mold it is chilled and solidified instantly. The resultant bar, which measures 6.5-inches wide and .700-inch thick, emerges continuously from the bottom of the machine at a rate of 10 to 12 feet per minute.

The bar of aluminum travels over a slack loop, then between the rolls of a hot mill which reduces its thickness to about .200-inch in one pass. The bar enters the mill at a temperature of about 900°F, emerges at roughly 25 fpm, is quenched to around 100°F, then travels directly into the cold mill, which reduces it to a final thickness of .125-inch.



View of continuous casting, rolling and slug blanking line as seen from slug punching press (foreground). Completely automatic line takes aluminum (alloy 1100) from melting furnace to continuous casting machine, then through hot rolling, quenching, cold rolling, cleaning and lubricating to punch press in one uninterrupted operation. Result: Very low conversion cost from pig aluminum to impact extrusion slugs. In the lower right hand corner can be seen part of conveyor that takes slugs to annealing furnace in right background. Watching the line are Jack Porterfield (left), chief engineer of Aluminum International and can department manager, and R. J. Hartmeister, superintendent of the can plant.

Sheared, Leveled, Blanked

From here, the slab passes through a flying shear, then through a roll leveler, then into a kerosene bath which removes any residual rolling oil and deposits a thin film of lubricant. It then travels over another slack loop and into the Bliss high-speed blanking press.

This 60-ton unit punches out three slugs per stroke at a rate of 300 per minute. Actual output is 230 slugs per minute due to down-time on the press to allow the slack loop to build up. Operation of the press is synchronized to movement of the slab by an automatic control in the slack loop.

From the blanking press the slugs are carried by chain conveyor into a Despatch gas-fired furnace which anneals them at 800°F for 1½ hours. The annealed slugs are then air cooled.

At this point the continuous operation is interrupted. Cleaning, deburring and lubricating of slugs are done by batch methods which Bill Coors describes as "crude and barely adequate." Soon to be installed, however, is a new Almco automatic washer and tumbler which was specially designed and built to Coors' requirements.

When this component is integrated into the line, annealed slugs will be conveyed to a hopper atop the machine. A device will then meter out a certain weight of slugs and dump them into the barrel. From there the machine will automatically accomplish several operations including washing, deburring, drying, applying wax lubricant, and drying. At this point the slugs will be ready to be either packed and shipped or conveyed directly to the impact extrusion presses.

"We've had aluminum experts come in here and watch our casting and rolling line, then flatly announce that our metal can't be worth a damn," comments Jack Porterfield. "Yet right over here on these extrusion presses you see this same metal being banged out into aluminum cans and you can't find a bad one in 20,000.

"And we roll the same metal down to thin stock for our can lids. The metal may not be good for foil, but it certainly satisfies our needs."

Production of can bodies is handled by two Herlan 400-ton horizontal impact extrusion presses. Slugs are dumped into a hopper from which they are fed automatically into the die cavity of each press. Each stroke of the press punch converts a slug into a can body, which is then fed directly into a Herlan rotary trimming and flanging machine.

(*Continued on page 92*)

Can bodies are fed automatically to a spindle conveyor which carries them through a 4-stage washing, etching and drying machine. The etch-type cleaning compound used here removes the extrusion lubricant and conditions the aluminum surface so that it will accept printing inks on the outside and a special vinyl lacquer on the inside.

Hopped-Up Printer

Can bodies emerge from the washer completely dry and are transferred automatically to a cylindrical offset press which applies Coors' 4-color printed design plus a clear lacquer overcoat. The German-made press was designed to print one can with each revolution of the drum, but Coors' retooled it to handle four cans per stroke.

As they come off the press, decorated cans are popped onto a peg chain conveyor which carries them through a drying oven. After an 8-minute travel through the oven they are transferred — again automatically — to the internal coater which applies a vinyl film over the entire interior of the can. A 20-minute travel through another oven cures the vinyl coating, after which the cans are ready to be packed and shipped to the brewery.

Production of lids begins at the continuous casting-rolling line. As the cast and rolled slab emerges from the cold mill it can by-pass the leveller and proceed directly into the coiler which rolls up a 600 to 700 pound coil of stock in about 15 minutes.

Coils are annealed in a Lindberg batch oven, then cold rolled down to .014 to .0145-inch thick lid stock. Coiled lid stock is washed, given a coating of wax (epoxy will be used in the future), then fed into one of the two lid blanking and forming presses. One stroke of the press blanks two pieces at a time, forming them into domed and flanged lids. Subsequent operations apply a latex sealing compound to the rim of the lid and cures the latex in a conveyorized oven. Sterile lids are then packed and shipped to the brewery.

Output: 110 Per Minute

The line presently produces aluminum cans at a rate of 110 per minute. The limiting factor is not in melting, casting, rolling, processing of slugs, impact extruding or printing. All of these operations could be speeded up. It's the transfer mechanism to the printing press that limits line speed, according to Bill Coors.

The can itself holds seven fluid ounces, compared with the 12-ounce capacity of the conventional beer can. A trimmed and flanged can body stands 4.281 inches high, measures 2.102 inches in diameter, has a .0118-inch thick wall and a .025 inch thick bottom, and weighs 18.3 grams. The lid is about .0145-inch thick and weighs 3.9 grams.

The plant presently gets about 20 can bodies per pound of aluminum melted. Another pound of metal yields about 70 can lids. Thus, allowing for scrap, the plant is presently batting out some 80-100,000 cans per day (two shifts).

Plans are underway to give the can a domed bottom. "This will strengthen it enough to enable us to cut the weight by as much as one and one-half grams," explains Ruben Hartmeister, superintendent of the can plant. "It doesn't sound like much, but we figure it'll save us roughly $80 per one hundred thousand cans produced. That will add up when our new can line starts running."

Installation of the new line was well underway early this month. Key components will include two new extrusion presses, faster transfer mechanisms, a new printing press, the new slug cleaning, deburring and lubricating equipment, and other items.

The new impact extrusion presses are designed to bang out aluminum cans at a 120-per-minute clip, about twice as fast as existing presses of equal size. This doubled speed derives from the eccentric crank action — a new type of drive for impact presses.

The punch of a conventional impact press is driven by knuckle-joint action. While this delivers heavy power at the bottom of the stroke, it also results in a rapid approach and return, giving the feed and ejection systems little time to perform their functions.

In the new presses, one of which was built by E. W. Bliss Co., the eccentric crank provides higher impact speed and allows more time for the feed and ejection apparatus to work. The Bliss press, a straight side, single action, 400-ton machine, is inclined 13 degrees from the horizontal. Its variable speed motor gives a speed range of 40 to 120 strokes per minute.

Will "Cruise" At . . .

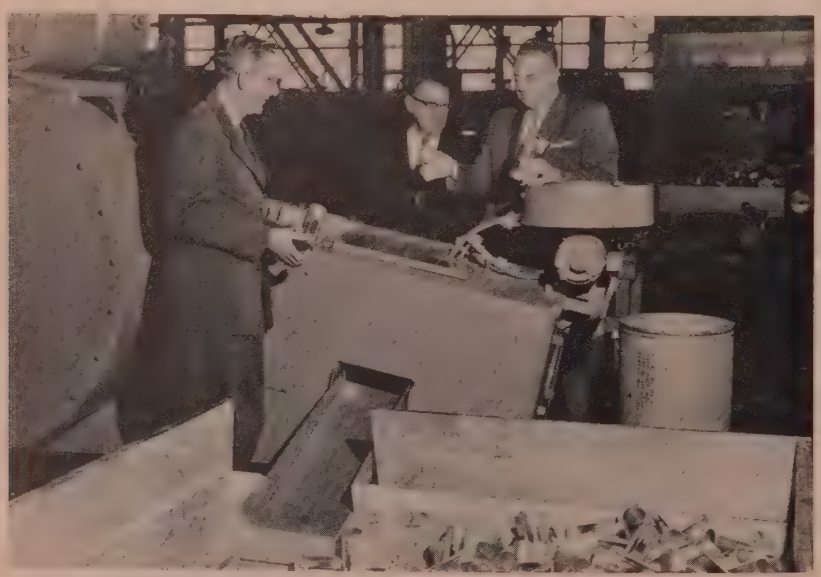
The new presses, plus faster transfer mechanisms and other components, will give the new line a comfortable cruising speed of 250 to 300 cans per minute. In addition, the present line will be hopped up to run at 140 cans per minute.

"We are so confident of reaching speeds equal to those of conventional can lines that most of the components of the new line are being sized for such speeds," Coors declared.

"From the outset, we committed ourselves to the idea that the aluminum can must be competitive with the tin plate can; we must be able to make it for what we would pay for a comparable conventional can. On the seven-ounce package we show a modest profit since our process favors the smaller can. The 12-ounce can would be a break-even proposition, based on our present prototype line."

This "prototype" owes its success to two main factors — low labor cost (five men run the entire operation), and low conversion cost from pig to slugs.

"I don't think we could get the conversion cost any lower without going to



■ ***One of the two new high-speed impact extrusion presses to be installed in the new line at Coors' can plant. Built by E. W. Bliss Co., Canton, Ohio, it will extrude beer can bodies at rates of up to 120 per minute, twice the speed of conventional presses of comparable size. Shown examining press are Jack Porterfield (right), chief engineer of Aluminum International, and A. S. Burgoyne (left) and B. E. Meyer, vice president of manufacturing and sales manager, respectively, of the Bliss Container Machinery Division.***

ıbstantially higher volume," Coors ob-
ırves. "At present we're casting at a
ıte of a ton an hour. We've boasted
› ourselves that if we pushed it to
000 pounds an hour — which is entirely
ractical — our conversion cost from
ıgot to slugs would be pared to about
hree cents a pound.

"We don't think it could be done any
heaper, unless you built your plant
ıext door to a primary smelter and got
. hot metal deal. That would eliminate
our melting cost, plus the freight on
ıgot. You would still have to ship
lugs — or cans — but you would realize
ı slight saving in freight."

As for the low labor cost, Coors gives
most of the credit to Jack Porterfield.
'He tackled a formidable assignment,
when he set out to automate that equip-
ment. Designing transfer mechanisms
that would handle aluminum cans at
the required speeds was a whale of a
job — but no more so than coaxing that
Mall press to print four cans at a time,
wet on wet on wet.

"If you asked me who should be the
'man of the year' for aluminum, I'd
name Jack Porterfield. Nearly all the
companies that are suddenly working on
aluminum cans are trying to hire him
away from us."

Can-Makers' Quarry

Porterfield, a quick-thinking, fast-talk-
ing mechanical engineer and metallur-
gist with several years' experience in the
impact extrusion game, is not afraid to
accept credit when it's deserved. But
he says the job would have been im-
possible "without all these bright young
men like Ruben Hartmeister, and Rudy
Hampf, who runs the casting line, and
Vernon Ells, who knows more about
printing presses than anybody I've ever
met."

They, in turn, pass the ball back to
Bill Coors. "It took courage to start a
project like this," Hartmeister empha-
sizes, "but it took more than courage
to keep plugging away at it despite the
disappointments. It took a million dol-
lars and four years of intelligent pa-
tience. Bill deserves most of the credit."

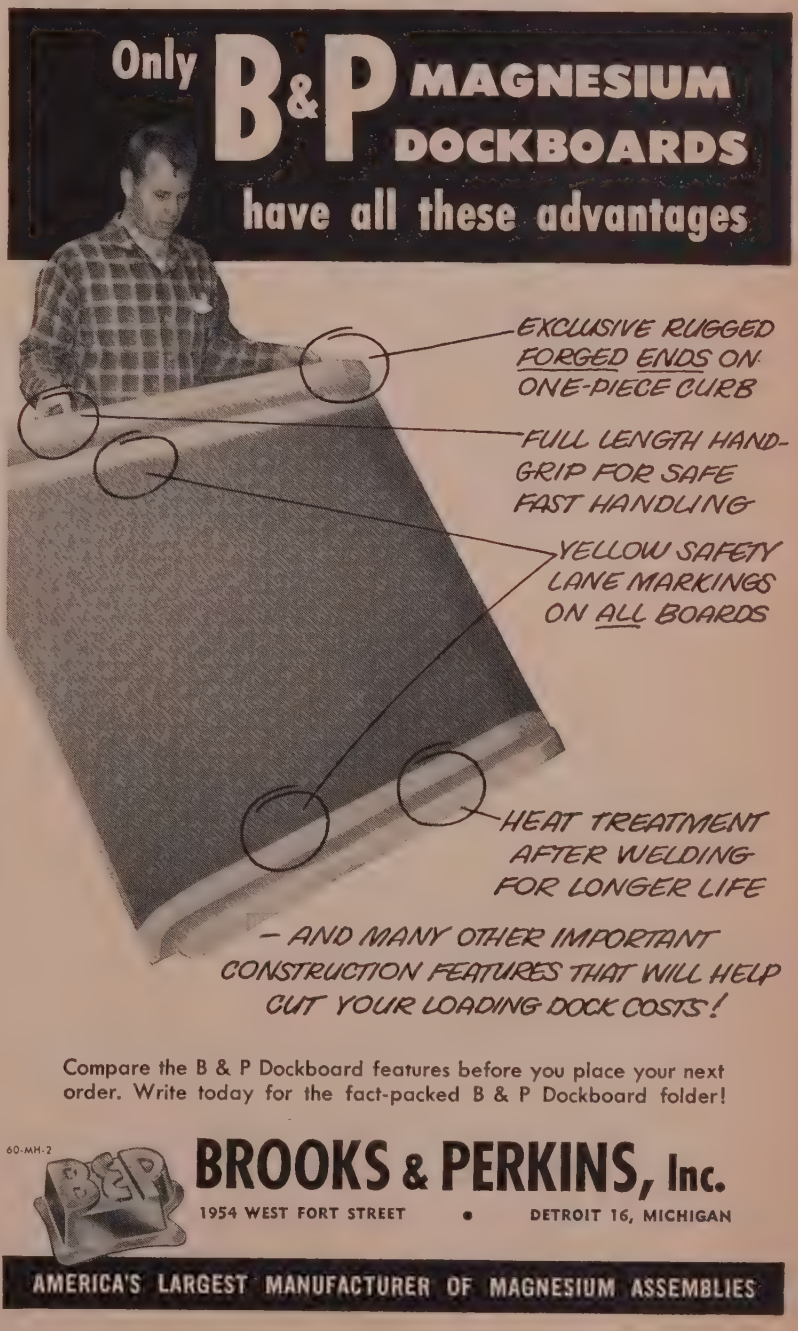
The expansion program now under-
way will more than triple the capacity
of the can plant. Much of the equip-
ment has been delivered; some of it is
installed and is undergoing shakedown
tests. The magnitude of the expansion
is convincing evidence of the success
of the aluminum beer can. It also fore-
shadows the company's intention to ex-
tend its activities in the aluminum can
field.

Consumer acceptance of the alumi-
num can has far exceeded Coors' hopes.
"We have watched sales steadily build
up to where they account for over 20%
of our package volume in Denver —
which is unusually high for a 7-ounce
package of any kind — and this was
achieved with no more promotion than
a small point-of-sale display," Coors
adds.

He concedes that other factors may
tend to becloud the issue. For example,
beer is packed in the can under aseptic
conditions. Since it is super filtered
rather than pasteurized, it has the draft
brew flavor that one doesn't get in
canned or bottled beer.

"We know that this has influenced
the remarkable acceptance of the alumi-
num can, but we don't know to what
degree. But the longer we observe this
marketing performance," Coors empha-
sizes, "the more convinced we are that
the aluminum can is the beer can of
the future. We now rank it as superior
to both glass and the conventional can
as a container for beer.

"Yet, with all its attributes, the alu-
minum can has one serious drawback:
It is extremely delicate, difficult to
handle, and hard to fill. We are much
more confident of our ability to make
the cans at speeds of 400 per minute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AMERICA'S LARGEST MANUFACTURER OF MAGNESIUM ASSEMBLIES

■ ***Aerosol cans, being a premium package, comprise one area in which aluminum is expected to give tin plate a stiff competitive battle. About 500 million aerosols are used annually, but the sales curve is rising sharply. With its high speed production methods, the aluminum aerosol should capture a sizable share of the market. Coors is tooling up to produce aerosols at its can plant.*** Photo Credit—Modern Packaging

than to fill them at this speed."

But the filling problem has been licked, according to Coors, and the brewery is gearing up the aseptic filling speed to 400 per minute from the present 130 per minute. Aseptic filling of the standard 12-ounce can will be more difficult, but the can plant seems to be moving in the direction of producing this size container in aluminum.

Next Project: Aerosols

With the success of the aluminum beer can established, Coors' can plant is tooling up to produce aluminum aerosol containers. It has obtained a license to make standard 3, 6 and 12-ounce aerosols by the Italian B. P. D. (Bombrini Parodi-Delfino) process.

The body will be impact extruded and the dome and neck will be formed by a 12-stage drawing and ironing operation. The Italian-designed equipment will handle 12 cans at once, turning out one complete unit with each stroke. Line speed is scheduled at 100 per minute initially, with 250 per minute the ultimate aim. Decorating will be done on the can plant's own equipment.

The aerosols are designed to hold 250 pounds of internal pressure, though the working pressure doesn't normally go above 100 pounds. Cans have been tested to destruction at 450 pounds.

"There's no question in our minds about the market for this type of container," comments Ruben Hartmeister. "Being a premium can, it's a natural for aluminum. Plenty of potential customers have expressed interest in buying aerosols from us. Now it's up to us to produce them."

Bigger things are also planned for Aluminum International, Inc. This jointly owned company produces nothing (the can plant is a division of Coors Porcelain Co). President of Aluminum International is Brown Cannon, who is also vice president of Beatrice Foods. Bill Coors is vice president and Jack Porterfield is chief engineer.

Once it carries its present processes beyond the development stage, Aluminum International will become a sales and engineering organization. Presumably it will license other firms to use its can making processes. As Bill Coors points out, the continuous casting-rolling process and the impact extruded can line are best suited to captive operations. Other breweries — notably the smaller ones — are good potential users.

Another intriguing possibility is cans for baby foods, a market that currently uses more than 2 billion glass jars annually. But the effects of light on baby foods, plus the cost-competitive aspects of aluminum in small containers, might be enough to eventually swing this growing market toward aluminum.

Bill Coors sums it up this way: "With what we have learned and know how to do today, the aluminum can is a practical economic reality — and it will get even better as time goes on."

The success of Coors' venture highlights an ailment that afflicts the can makers, the can users, the steel industry and, paradoxically, the aluminum producers. But though the disease is the same, the symptoms are markedly dissimilar. A succinct diagnosis was made over two years ago by Dusty Rhoades, president of Kaiser Aluminum & Chemical Corp.

"The packaging industry is passing through a transitional stage," Rhoades observed, "and the traditional materials will have to re-prove their worth in the light of new and improved methods of packing and selling."

To can makers, this transition raises the specter of new designs, new manufacturing methods, costly equipment and perhaps the loss of business as old-time customers install their own container facilities.

Few can makers may be ready to concede that the tin can is less than perfect, but most of them must feel at least slightly uneasy about the inroads made by plastic bottles, semi-rigid foil containers, plastic-foil pouches, and the like. They cannot afford to ignore the potential threat posed by new food processing methods such as quick freezing and irradiation.

The transition is a source of discomfort to can users, as well. New types of containers will probably mean new or modified packing methods and equipment. They may even have to make some of their own containers. In any event, they must keep pace in today's extremely competitive marketplace.

Nightmare for Steel

The steel industry's problem is obvious enough: The steady erosion of a traditional market as new materials struggle for a bigger slice of the container business. And while fighting a rear guard action, they must cope with the uncertainty of their tin supply.

Aluminum's dilemma is less easily analyzed. Despite the impressive advantages of their material, the producers must engage in a price battle before they can hope to establish a firm foothold in the can market. They must be prepared to compete in a high volume, low margin business.

That they are willing to meet this challenge is evident in recent moves to establish so-called commodity prices for sheet can stock. Before the recent price increases, for example, the price of .010-inch thick 5052 alloy sheet had been chopped from 56.8 cents a pound to 32 cents. It has been reported that the price of sheet was trimmed even more for one of the big oil can jobs, and the cans are said to be delivered at the same price as tin plate cans.

But even at the commodity prices, aluminum is still higher than tin plate. At last spring's meeting of the Canners Association, two American Can Co. engineers noted that a base box of 30-

DIE CAST ALUMINUM ROTORS with insert laminations are automatically ejected, lifted to the conveyor and delivered to the next station for gate removal. A four cavity mold is used on this 500 ton Cast-Master.

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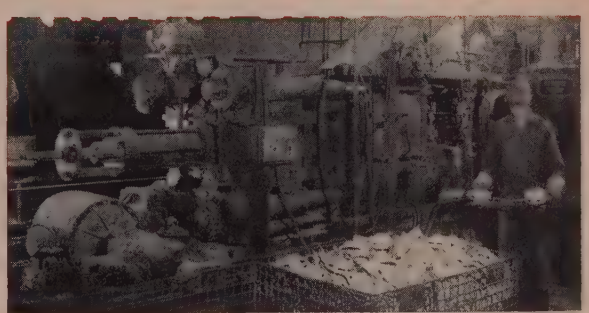

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inch wide coils of .010-inch sheet was priced at $8.15 in tin plate and $9.82 in 5052 aluminum alloy. Note that this is on a volume basis, not poundage.

Even so, the commodity price puts aluminum within reach of tin plate. This is good news for can makers. With aluminum cans they can realize sizable savings in shipping costs. They can also sell the scrap (tin plate scrap has little salvage value). Perhaps more important, they can use the low aluminum price as a strong talking point against any increase in tin plate prices.

In any event, the entire price issue is obscured by other circumstances. For example, aluminum is most competitive with tin plate in the thinner gauges (steel companies show signs of rectifying this). However, thicker gauges of aluminum must be used for strength reasons when big cans are involved. And big cans alone account for a little over half of the tin plate used.

Best Gains in Oil Cans

Curiously enough, aluminum seems to be making its most impressive gains in this size range—specifically, one-quart cans for motor oil. One of the primary producers estimates the potential for aluminum in this market at 100,000 tons annually. However, the difference between the potential and present performance is striking. An estimated 5000 tons of aluminum went into oil cans last year. This year's total is expected to jump to 18,500 tons, while 1961 could see 35,000 tons going into oil cans. (These estimates are by one of the producers.)

The principal user of aluminum oil cans is Esso. Reynolds Metals got the ball rolling back in October 1957 when it worked out a deal under which it would supply the sheet for some 35 to 60 million oil cans to be made by American Can Corp. and Crown Cork & Seal Co.

These companies were to supply the cans to Esso at the same price as steel cans. A unique plan for salvaging used cans was supposed to be the secret of aluminum's success in this application.

Today, virtually all oil companies are said to have expressed an active interest in aluminum cans. Besides Esso, these include Mobile Oil, Sun, Texaco, Union, Richfield, Tidewater, Standard Oil of Ohio, Phillips, Gulf, Socony, Quaker State, Magnum, Sta-Lube, American Oil, Sunray, Cromwell, Bray, Pennzoil, Standard Oil of California, Standard Oil of New Jersey, Ashland, Kendall, and Castrol. These, needless to say, represent the bulk of the oil industry.

But "interest" in aluminum oil cans is one thing; actual volume use of them is another. Aluminum may stand a better chance of capturing a major share of the market for can ends, which account for around one-third of the total weight of an oil can.

The potential here is 35,000 tons of aluminum annually. Aluminum can give tin plate a closer battle for this business because can ends are slightly easier to make in aluminum, and the scrap can be recovered. Scrap rates are high on can ends—much higher than is the case with the bodies of 3-piece cans.

In fact, the composite can — tin plate body, aluminum ends — is an attractive proposition for many applications. The problem of galvanic corrosion is overplayed, according to at least one aluminum expert, since cans must be internally coated and externally decorated for most uses. On the other hand, recovery of the aluminum can ends would probably be impractical.

Some Typical Aluminum Cans

Photo Credit—Modern Packaging

■ ***Major markets for aluminum cans are represented here. Largest tonnage outlet should be 3-piece cans for motor oil (top). Frozen fruits and juice concentrates (second shelf) will also be sold in 3-piece aluminum cans. Impact extruded beer cans (third shelf) are present production items, as are drawn and ironed beer can and drawn sardine can on bottom shelf.***

Most of the aluminum producers seem to agree that their best chance of staging a full scale invasion of the can industry is with can ends. One reports that a large brewery in the east is well on the way to adopting aluminum tops for beer cans (they're cleaner and easier to open). It is also rumored that another producer is working closely with one of the biggest can makers in the development of composite cans for frozen citrus fruit concentrates.

Target: 1 Billion Juice Cans . . .

Other producers — notably Kaiser — seem to be convinced that aluminum stands a good chance of grabbing a major share of the frozen juice concentrate business with an all-aluminum can. Last month, for example, Libby, McNeill & Libby announced that it was switching to aluminum cans for its 1959-60 pack of frozen orange juice concentrate.

The 5-color lithographed cans will be produced by Crown Cork & Seal, using aluminum sheet supplied by Kaiser Aluminum. Continental Can may also make the cans. Libby indicated that it could use up to 100 million of the cans, providing they were available when packaging of the 1959-60 line of orange juice was to begin. It is reported that Libby is considering aluminum cans for other products, as well.

Principal advantage of the aluminum juice can, aside from the fact that it doesn't rust, is the considerable saving in freight costs. The aluminum can weighs 40 to 50% less than its steel counterpart.

Minute Maid Corp., one of the largest packers of frozen juice concentrates, figures it could save $300,000 annually in freight costs by switching to aluminum cans. Minute Maid has investigated the possibility of using impact extruded cans, but seems to have settled on a conventional 3-piece aluminum can with .008-inch thick body and .009-inch ends. It will be run through conventional filling lines.

Minute Maid has not divulged how much of its orange concentrate will be packed in aluminum cans. The firm used 250 million tin plate cans for this application in 1958.

Slightly better than one billion 6-ounce cans of frozen orange juice were sold in the U. S. in 1958. Had they been made of aluminum, they would have consumed nearly 14,500 tons of the metal. It's a substantial market to shoot at, and aluminum stands a good chance of making headway here because it is at its best in the small "premium" container.

A packaging expert of one of the primary aluminum producers believes that the citrus fruit industry as a whole could eventually use 30,000 tons of alu

■ *Standard Oil Co. of Indiana has been packaging three grades of its motor oil in aluminum cans for the past seven months. The filling is done at Standard's Wood River, Ill. refinery, at a rate of 2 million cans per year.*

minum annually. An equally well informed spokesman for another producer pegs the total at 35,000 tons.

. . . and 8 Billion Beer Cans

To the dismay of temperance groups, Americans drink more beer than canned orange juice. At any rate, statistics indicate that 8 billion cans of beer are sold in the U. S. annually. It's the fastest growing market for tin plate cans, and should beep on growing as the bottle declines as a package for beer.

Understandably enough, the steel companies are less than enthusiastic about developments such as the Coors can line, particularly when other breweries follow suit. In Baltimore, for example, Gunther Brewing Co. is now using a small aluminum beer can, not unlike that produced by Coors.

The Gunther can, however, is a drawn and ironed unit, produced by Kaiser Aluminum for American Co. Canco, in turn, supplies the can to Gunther. Unlike the impact extruded can, this package is made from 3003 aluminum sheet. It is similar to the Coors can in that it is a 2-piece unit — body and lid. The lids are stamped from 5086 alloy by Canco.

Since it is made from a stronger alloy and receives a great deal of cold work in the drawing and ironing process, the Gunther can is suitable for conventional pasteurized processing. It is capable of withstanding 100 pounds of pressure.

Kaiser's drawing and ironing process is an improved version of the Keller process of Swiss inventor, Jakob Keller. Whereas the Keller press is a single action mechanical machine, Kaiser's equipment employs hydraulic power and produces a can body on the return stroke as well as the forward stroke. This speeds production, but it is still well below that of the conventional can line.

Kaiser reportedly is developing a draw-and-iron press that will bat out aluminum cans at a 400-per-minute clip. If it proves successful, and if it holds the quality achieved by Kaiser's present press, this should certainly make the drawn and ironed aluminum can a strong contender. A special advantage of cans produced by this method is their bright, mirror-like finish — a strong sales point for products that depend upon "impulse" buying.

Terrific Tonnage in Tops

Although the quantity of aluminum cans used by Gunther is small, the application took on added significance recently when the Baltimore brewery was taken over by Hamm Brewing Co. This well-known midwestern brewery, reputedly one of the big five in the U. S., is moving toward national distribution.

The Gunther aluminum can experiment will be continued by Hamm Brewing, and the possible wider adoption of the new container would enhance aluminum's prestige considerably.

At least one aluminum industry man thinks that the metal's best chance of invading the beer can business is through the top. As mentioned earlier, can ends are easier to stamp out of aluminum, and the stamping scrap can be recycled or sold. One brewery in the east has already ordered aluminum tops for its premium line of canned beer.

Reason: The aluminum top will be an advertising gimmick. It is inherently cleaner than tin plate tops, our informant told us, and it is considerably easier to open — a feature that women will welcome. Speculating on the potential tonnage involved, he figured the application could take nearly 100,000 tons of aluminum annually if all beer can tops went to aluminum.

The aluminum beer can is also being promoted by one of the leading machine tool manufacturers. E. W. Bliss, builder of the new high speed impact extrusion press for Coors, believes it is on the threshold of a healthy new market for machinery.

A Bliss spokesman recently "guesstimated" that aluminum might capture 20% of the beer can business within four or five years. If, by that time, the nation's brewers used no more than the 8 billion cans they sold last year, that would come to 1.6 billion beers cans using some 67,000 tons of aluminum.

In an effort to keep all bases covered, Bliss is working on equipment that will produce not only the impact extruded cans, but three-piece cans, drawn cans, and drawn and ironed cans, as well. The company will ultimately set up to engineer and install complete turnkey operations for breweries, fruit juice processors, and other potential users of aluminum cans.

The Bliss move carries special significance for aluminum. One oft-quoted objection to aluminum in the can business is the lack of efficient machinery to process the metal. The Bliss program should do much to break that roadblock, and it's reasonable to assume that other machine tool outfits will not sit idly by and let Bliss run off with the business.

But How Much Metal Now?

Much of the foregoing speculation concerns the prospects for aluminum in the future. But what are the prospects for this year? The primary producers have come out with forecasts for 1960 — and, as might be expected, there's quite a divergence of opinion.

A Reynolds official, for example, thinks that 48 million pounds of aluminum will be used in cans in 1960. He sees 37 million pounds going into cans for oil, 6 million into orange juice cans, 3 million into beer cans, a million into aerosols, and a million into miscellaneous containers.

An Alcoa spokesman was considerably more optimistic. He thinks 100 million pounds of aluminum will be used in cans this year, but he did not divide the total into types of cans.

A survey by Kaiser Aluminum puts the total between these two estimates. According to the Kaiser forecast, can

■ *Minute Maid Corp., Orlando, Fla., thinks it may save $300,000 annually in shipping costs alone with aluminum cans like the one shown here.*

CAN MAKERS REPORT ON ALUMINUM

Eight can makers' replies to Modern Metals' questionnaire

National Can Corp., Chicago, Ill.

We think there is a future for aluminum in impact extruded cans such as aerosols, and drawn items such as can ends and sardine can bodies. National Can has also been experimenting with the small citrus concentrate can, which does not require soldering and which, when filled, offers the advantage of a greater freight saving than other cans.

It still costs more to get out of aluminum the equivalent strength of steel can-making plate, but there are some applications where this differential is not too important.

Most aluminum cans are not yet, in our opinion, in the realm of practical economics. But with the attributes the metal has shown thus far, it will achieve a place of proportionate importance in the products of National Can.

Clarke Can Co., Inc., Philadelphia 25, Pa.

We are most optimistic about our ability to enter the aluminum can market by utilizing the one Herlan impact extrusion press we now own. We do not intend to compete with established producers who are turning out a few standard items, particularly in the field of aluminum aerosol cans.

Because of our ability to extrude cans somewhat larger than most producers, it is fitting for us to cater to fillers who require "king-size" cans. We have also entered the field of aluminum cans for welding electrodes . . .

As a small manufacturer with limited technical facilities, we have found that proper design, tool design and choice of materials are a difficult task. Although the primary producers of aluminum deserve an "A" for effort, they fall far short of meeting our technical needs.

The Central States Can Corp., Massillon, Ohio

We have a substantial program under way for the manufacture of aluminum cans using the draw and redraw method. Because of the competitive nature of our work we cannot provide detailed information at present.

Liberty Industries, Inc., Brooklyn 5, N. Y.

We are manufacturing an aluminum container of a very light gauge which comes under the heading of foil containers. We are contemplating the manufacture of the conventional three-piece aluminum container, but on a specialized basis. It is our feeling that the future of the aluminum can will be in the three-piece type, provided the problem of soldering the side seam is solved.

Otoe Food Products Co., Nebraska City, Neb.

We have spent considerable time and effort in experiments with both round open top cans and drawn cans. . . . The experiments were not satisfactory; when processing foods with a vacuum . . . the container collapsed in almost all instances during sterilization.

We are still conducting experiments along this line and we believe that eventually the aluminum can will be practical and will be accepted.

George D. Ellis & Sons, Inc., Philadelphia 40, Pa.

Aluminum cans which we are currently supplying for the packaging of bearings include Can No. "O" (1½" x 1") with compound lined top, the Can No. "O" with the top double seamed, and Can No. "1-A" (2⅛" x 1¼").

Bearings are packaged in these cans in oil and the compound lined top is double seamed onto the can for hermetic sealing. We are tooling up on a number of other sizes used for the packaging of bearings. We also produce other special seamless aluminum cans and larger cans of seamed construction.

J. L. Clark Manufacturing Co., Rockford, Ill.

We are offering a new line of drawn aluminum cans with compounded covers for a wide variety of packaging applications. The two-piece cans are produced on automatic equipment and meet rigid government specifications.

The cans are available in 18 sizes ranging in diameter from 1½" to 6¾" and in depth from 1" to 2¾". These aluminum cans offer solutions to packaging problems for many types of products.

United Can & Glass Co., Hayward, Calif.

We manufacture cans as well as can machinery. We primarily manufacture sanitary cans for fruits and vegetables, pet food, etc.

We have become involved in the aluminum oil can program and have had some experience in manufacturing a three-piece, cemented side seam aluminum oil can. We also see possibilities for the same type of can for frozen juices, etc.

I think that aluminum cans of the three-piece type offer the best potentials. With the two-piece can there are too many problems such as slow production speed and the handling of cans in packing plants.

At present, aluminum is subsidized by the major producers to compete with tin plate. Sometime it will have to be resolved as to whether they can make aluminum sheet to compete with tin without suffering this continued loss.

producers in the U. S. will consume some 50 million pounds of aluminum in 1960 – better than three times the amount of aluminum used for this purpose last year.

Noting that Kaiser had established commodity prices on can stock two years ago, the report pointed out that the lower price is made possible "because of savings in rolling sheet within a narrow range of gauges and specifications on large volume orders."

In a bid to capture a bigger share of this business, Kaiser is installing three high-speed can lines at its Trentwood, Wash., rolling mill. One line will trim aluminum strip to width and remove mill oil; the second will pretreat strip, coat one or both sides, then oven-cure the coating; and the third will flatten and cut strip, then sort, grade and stack sheets, ready for packing and shipping.

Initial capacity of the line, which is scheduled for operation by mid-year, will be 4 million pounds per month.

The Global View

Aluminium Limited has not put out a forecast for aluminum in cans in 1960, but a spokesman for the company's big Alcan subsidiary thinks the U. S. can industry alone will ultimately consume from 350,000 to 400,000 tons of aluminum annually.

Limited, through its subsidiaries in other countries, has been selling aluminum to can makers for several years. Our informant figures that 15.5% of the cans used in Norway are aluminum, while in Switzerland aluminum accounts for 8% of the total. Approximately 4.2% of Italy's cans are aluminum, while the metal accounts for some 2.6% of all cans used in Germany.

Among recent aluminum can developments in the U. S., he sees particular significance in the shallow drawn aluminum can used by Franco-Italian Packing Co. for packaging sardines. The California packing firm adopted this can for freight-saving reasons, but is now promoting the new package in its advertising. The can is produced by American Can from Kaiser Aluminum sheet.

Although the can industry cannot be considered a major market for aluminum at present, there can be no doubt that it will jump into the heavy tonnage class within a few years. The primary producers will continue to pour on the promotional heat; can makers will be forced to pay more attention to aluminum from here on; and the relatively small can maker-user like Bill Coors will become an increasingly significant part of the picture.

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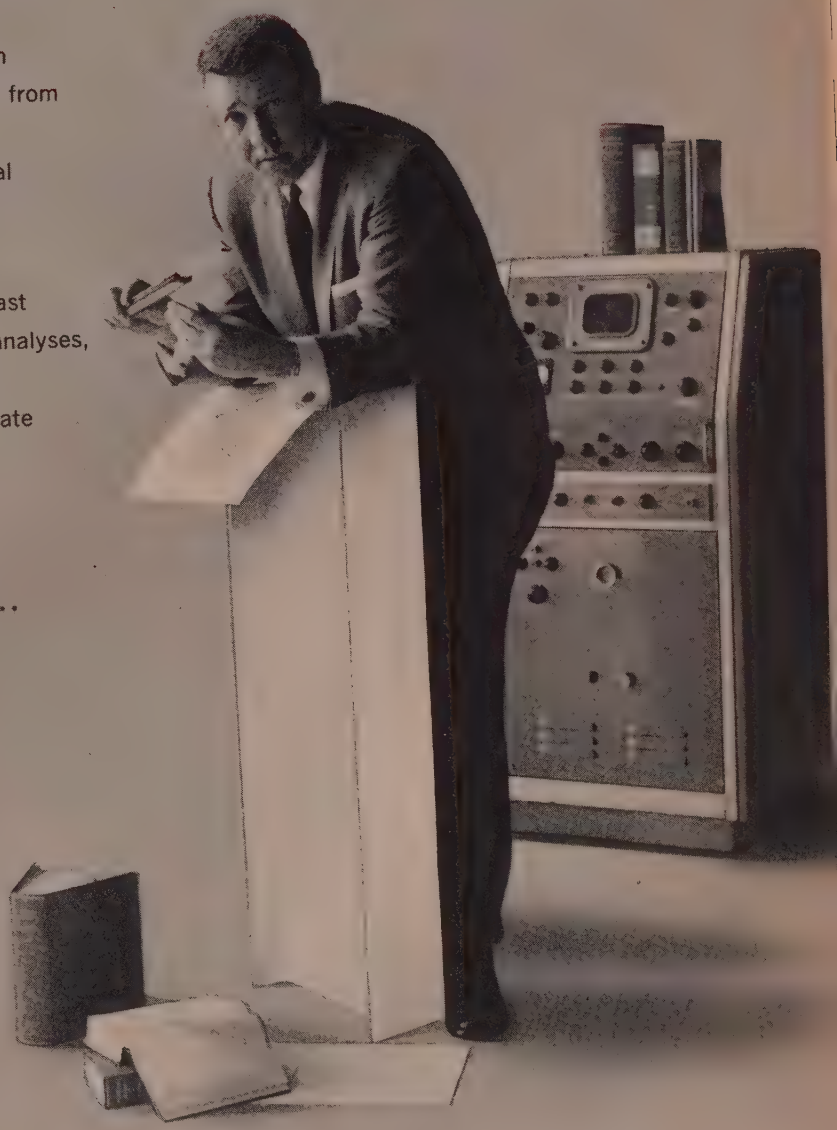

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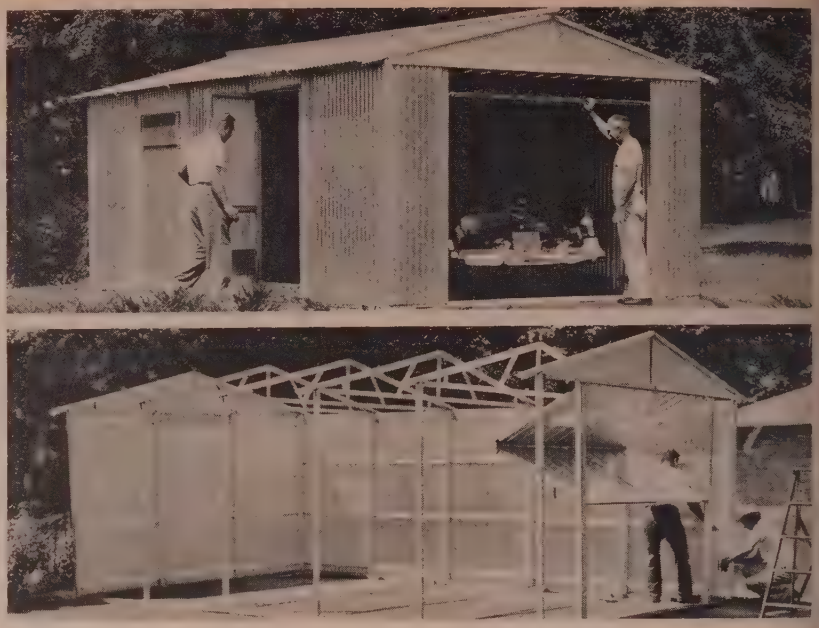


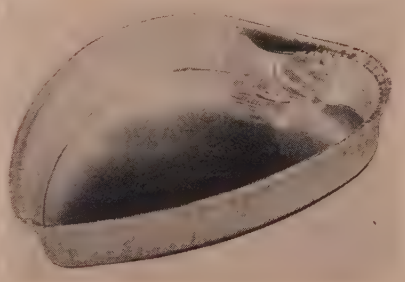
Fast Erecting Building Is Portable, Expandable

Buildings of aluminum extrusions and rib type panels that can be erected in one hour are being developed for sale by Magic Industries Inc., Indianapolis.

The portable buildings come in standard widths of 12, 16, 20 and 24 feet with heights of 7 and 12 feet. Expandable lengths are available in 4-foot sections. The basic 12 by 20-foot unit weighs only 650 pounds.

Erection is done in four steps using only a ladder, pliers and square level. First, base is laid out and leveled, then extrusions are set up, panels applied and finally, roof panels are locked with ridge extrusion and base is anchored with stakes. Erection should take 60 minutes, dismantling 30.

Company designers see use for building by homeowner, farmer, contractor on job, snack bar operator, fisherman and hunter, etc.



Heart-Of-Foil Used in Packaging

A heart-shaped aluminum foil container has been introduced by Ekco-Alcoa Containers, Inc., Wheeling, Ill.

The red container is suitable for bakery goods, ice cream products and candies. It will have special impact on such occasions as Mother's Day and Valentine's Day.

Designated 690-35, the container top-out dimensions are 9-5/8 by 9-1/2 inches, and the depth is 1-3/8 inches. The manufacturer says the container has approximately the same volume as a standard 8-inch layer pan.

Aluminum Tinning Process Completed in Four Minutes

A new process for the immersion tinning of aluminum parts, using ARP 200 Stannate M, has been developed by Allied Research Products Inc., Baltimore supplier of metal finishing chemicals.

The process has been used to treat aluminum pistons for all types of engines, aluminum transmission components, etc.

The special compound used is mixed with water and produces an adherent tin coating on the work after a four-minute immersion in the bath at 165°F to 175°F. Little sludge is formed and there is no need for control of hydroxide content or for acetic acid solutions. Periodic checks of tin content are necessary, says manufacturer, with additions of powder maintaining bath in proper operating condition almost indefinitely.

Alcoa Is Fabricating Aluminum Clapboard

Aluminum Company of America and five major producers of residential building products will market a new Alcoa product — 8-inch aluminum clapboard — the only type of building siding fabricated by Alcoa.

Alcoa siding will be sold exclusively by 25,000 dealers and dealer-applicators of the Barrett Div., Allied Chemical Corp., New York; Bird & Son, Inc., East Walpole, Mass.; Flintkote Co., New York; Mastic Corp., South Bend, Ind.; and the Philip Carey Mfg. Co.

The new siding employs the "layer principle" which, according to Alcoa, achieves greater strength, higher resistance to corrosion, excellent insulating and weathering qualities, and simplifies installation.

Panels are of alclad aluminum sheet, backed by foamed plastic which serves as a stiffener and insulator, and by aluminum foil, which adds strength while acting as reflective insulation.

The clapboard siding was designed to save the home owner maintenance, heating and air-conditioning expense, said Thomas J. Lannen (above), Alcoa's manager of residential sales. "Tests indicate that a family living in a home containing 1,200 square feet of floor space can expect to save as much as 33% a year on heating bills," he said.

Cost-saving ability of the siding was determined by tests conducted at Pennsylvania State University. Two simulated homes, containing 1,200 square feet of floor space and 15% of wall area containing windows with storm windows attached were used.

Siding will be produced in five sheenless colors: white, green, gray, yellow and beige.

Advantages of the siding include drip design which prevents streaking by guiding water directly to the ground, and hidden vent holes and interlocking panels which insure a weathertight seal while concealing nailheads. Siding is applied with aluminum nails which will not corrode. Nail slots are elongated to allow for expansion and contraction in summer and winter.

Alcoa siding will cover any type surface, including wood, stucco, shingle and concrete block.

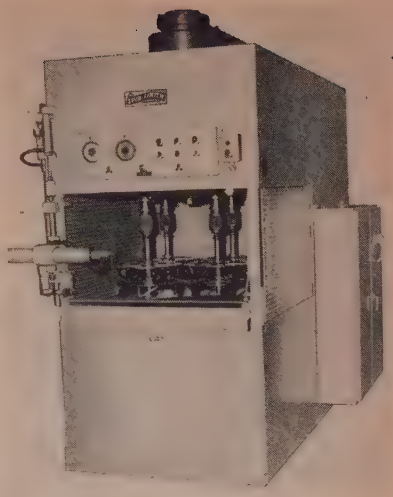
Heavy Duty Machine Does Pre-Plate Finishing

The machine pictured above mechanically finishes odd shaped stampings, castings and extrusions in preparation for plating.

The technique is called spin-finishing because the work is attached to rotating fixtures which are carried through the buffing compound in a circular path. Manufacturer of the Spin-Finish machine is The Gravi-Flo Corp., 400 Norwood Ave., Sturgis, Mich.

The machine is of heavy welded steel construction to handle the 40 h.p. motor drive and associated work load. Rotating head and spindle assembly is driven through a heavy duty combination helical and spiral bevel type right angle speed reducer, through a fluid coupling with attached V-belt sheaves.

When the machine is started the motor starts at slow speed to allow the work spindles to penetrate the buffing medium as the tub rises; then automatically changes to high speed during the processing cycle.



The machine operates for a predetermined time in forward rotation, then reverses for a time until process is completed. The spin-finish process makes use of five different compounds to produce a range of finishes from satin to color buff. The work can be finished in one operation, except that parting lines must first be removed. Average cycle time is six to eight minutes. The machine pictured will finish parts up to 12 inches long.

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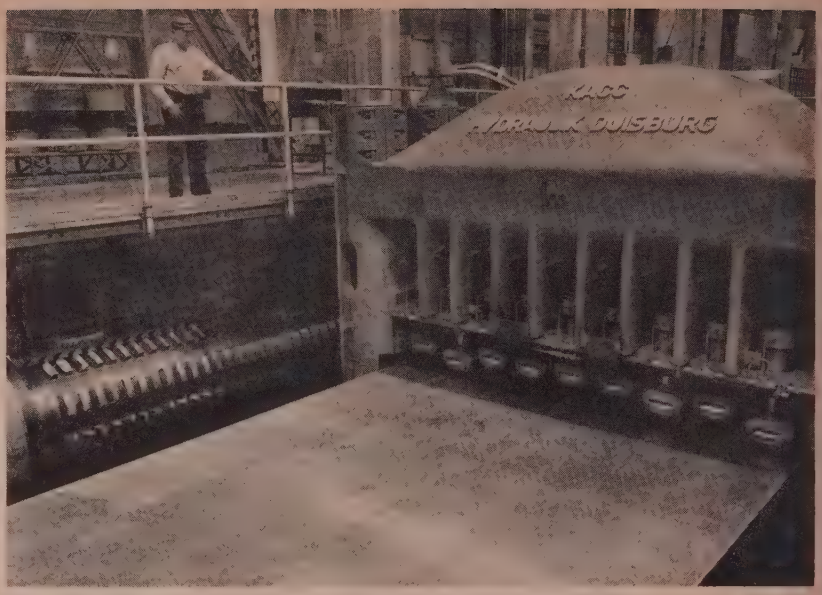

Giant Stretcher Expands 60-Foot Plate Four Feet

Sitting in a concrete pit 120-feet long, 32-feet wide and 15-feet deep at the Ravenswood, W. Va. Works of Kaiser Aluminum & Chemical Corp. is a giant machine with a 30-million-pound pulling force capable of stretching a 60-foot-long high-strength aluminum plate as much as four feet.

The pulling force of the massive unit is said to be nearly twice that of other stretchers in the metals industry. The machine can handle aluminum alloy plate up to 6 inches thick and 13-1/3 feet wide, within an overall cross-sectional area limit of 640 square inches. Previous industry maximum was about 350 square inches.

Purpose of the stretcher is to refine the internal structure of the metal by equalizing stress distribution in heat treated and welding alloys that are gaining increasing use in a wide variety of applications. These include marine construction, chemical processing equipment, railroad tank cars, and cryogenic equipment.

To handle the tremendous forces involved the machine is supported, without a guiding frame, on tracks and no effort is made to hold it in rigidly fixed alignment. Individual heads are supported on each side by eight railway type car wheels on a double track. Innovations in the hydraulic system keep the two sides of the machine parallel and completely independent of the load in the gripping jaws.

Stretching force is provided by 6000-psi hydraulic pressure on two large 56-inch diameter cylinders. To absorb the tremendous forces that would be involved should a plate break while being stretched at full power, the jaw mechanism includes a hydro-pneumatic system similar to the recoil equipment on a heavy cannon.

Maximum stretching speed is approximately one foot per minute and maximum speed of manipulating is 20 feet per minute.

The size of the giant is shown by some statistics; each half of a gripping head weighs 132 tons, and the two halves are held together by six forged tie bolts, 15-inches in diameter and 15 feet long. However, special design techniques have kept total weight to less than 3-million pounds.

Kaiser's Advanced Engineering Design Section blueprinted the stretcher, and it was built by Hydraulic G.M.B.H. of Duisburg, Germany.

Alloys Developed For Hot-Water Uses

Sheet and plate alloys which resist corrosive perforation by hot water are new products of Alcoa.

The new alloys were developed in cooperation with two water-heater manufacturers who now use the alloys in their current product lines, particularly for those machines where 180° F water is used.

Alcoa says the alloys will not produce red water and will not break in transit. The firm adds that the materials will save shipping costs, and that they have fast heat recovery rates.

The new developments combine specially designed alloys in a single fabricated form. The clad surface is a corrosion resistant material, and provides electro-chemical protection to the core alloys.

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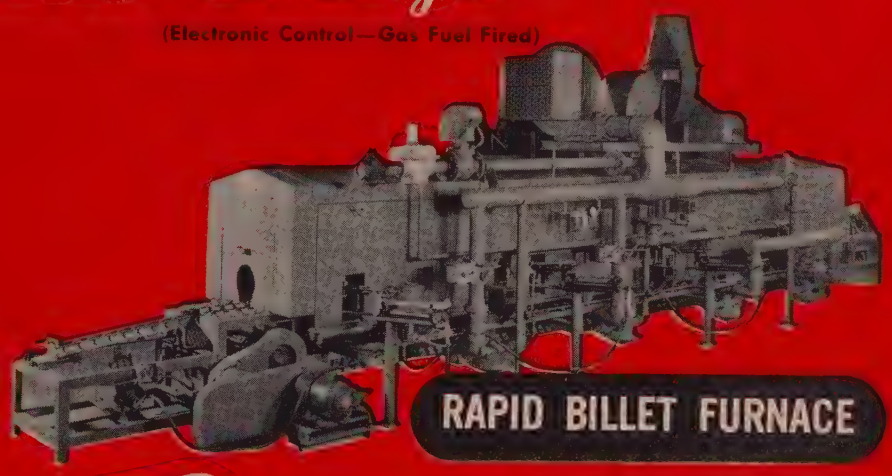

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Electrogas is being used in the extrusion plants of almost all of the primary aluminum producers; is the ideal replacement for old-fashioned soak type furnaces in smaller extrusion plants.

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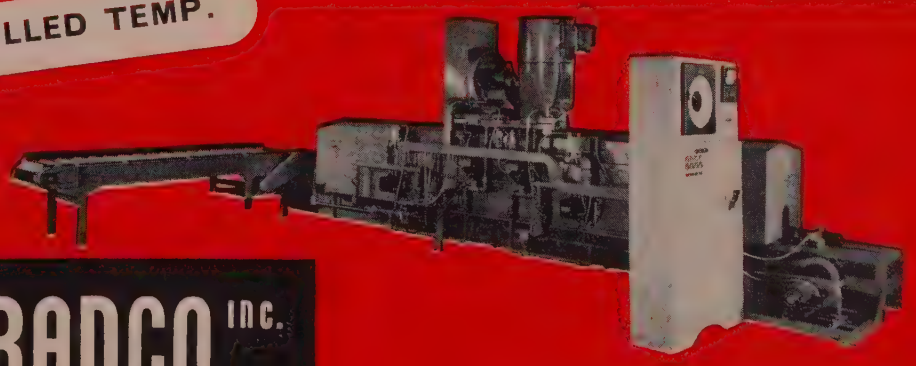

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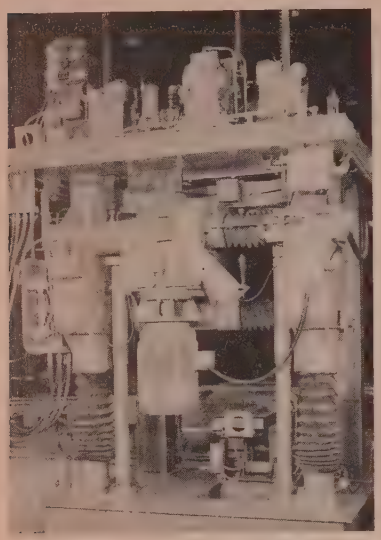

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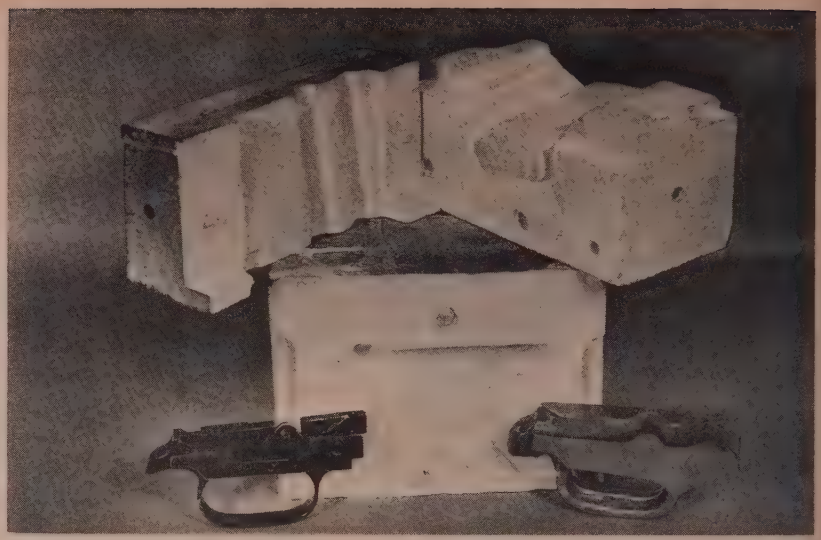


Casting Done With Aluminum Molds, High Melt-Point Metals

Niforge Corp., 677 Beacon St., Boston, has a new process which makes it possible to pour high melting point metals into lower melting point aluminum molds. The patented Parlanti mold process makes use of an anodized aluminum mold which produces a regulated chilling of the molten metal by controlled heat transfer.

Examples are the "as cast" titanium trigger guard shown at the right, and the finished, machined and black anodized aluminum casting shown on the left. Both were poured in the same mold.

The titanium casting is 6AL-4V alloy and has an ultimate tensile strength of 155,000 psi. Elongation was 3% in 1 inch. Aluminum alloy 195, heat treated, provides a tensile strength of 62,700 psi for the other casting. Elongation was 10%.

The titanium casting was poured under high vacuum conditions. There were no detectable effects of surface contamination due to attack on the mold wall by the molten metal.

This process is said to produce highly dense, fine grained castings. The high physical properties and integrity of metal approach those expected of forgings, says Niforge.

1959 Titanium Shipments Total 3100 Tons—UP 20%

Shipments of titanium mill products jumped 20% last year, to 3100 tons, while prices continued their downward trend, alloy development gathered momentum and the market base broadened.

Military aircraft construction in 1960 will largely determine the level of titanium shipments according to Titanium Metals Corp. of America, New York. But, because of the developmental nature of missiles, ordnance, maritime, chemical and electronic markets, and fluctuating decisions concerning manned aircraft, sound predictions of this year's shipments are difficult to make.

Manned military aircraft continued to dominate the markets for titanium in 1959, but significant inroads were made by missiles and civilian applications, each accounting for 15% of total shipments. Most important use was for motor cases of solid-fueled rockets, the rocket case used in the fourth stage of the Juno II booster, and a new titanium alloy developed to increase the metal's temperature ceiling in jet engines, but which gives promise of finding wide use in missile airframe structural members.

However, missile building in the future may not account for as much material as manned aircraft, since missiles require less material per unit, and few copies of each unit will be produced. But, advances made in this area in 1959, indicate that other future applications of titanium are in the offing.

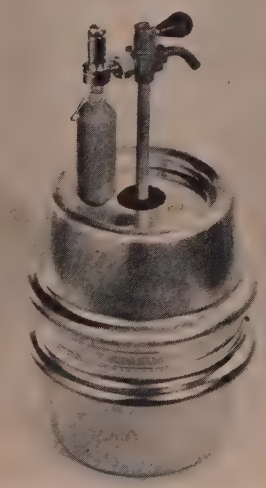
The industry continued to show progress in establishing a chemical market, according to Timet. The firm points to two important factors influencing sales: performance of titanium to date has been so outstanding that all metal shipped to the process industries so far has not required replacement; and, the metal is being used as a replacement for other materials, such as stainless steel, when their failure results in product contamination or in line shutdowns caused by corroded equipment.

Expanded use of titanium reflects its continuing price reduction and the payback inherent in titanium construction. Mill prices were cut three times in

1959, with the Timet index showing composite prices at $7.22 per pound, and sponge costing $1.60. The firm says, "On a volume basis titanium billet is now in the same pricing area as vacuum-melted steels demanded by the missile industry."

The firm sees future accomplishments which will further expand the use of titanium. Work is being done on production of permanent titanium anodes, to replace graphite, used in producing chlorine. Plate-type heat exchangers, to replace tube-bundle construction, may be a market for flat-roll, while sheet as lining for various types of equipment presents prospects when titanium to carbon steel welding is perfected.

Development of titanium castings has finally been accomplished, but only on an experimental level. A technique for economical mass-production remains elusive.



Aluminum Beer Barrel Has Home Tapping Unit

Breweries can now sell draft beer in a new 3.87-gallon aluminum keg equipped with a new tapping system designed especially for home, picnic and party use. It is an addition to the line of aluminum beer barrels made by Benson Mfg. Co. and sold by Reynolds Metals Co.

The barrel holds about 60 glasses of beer, and can be handled on standard racking and keg washing equipment with little or no modification. The special threaded fitting in the new barrel is designed to hold the Champion Fluid Kontrol system of Champion Sales Builders Co., Cleveland.

The unit has surgical-rubber jaws and a rubber rod-seal through which the tap rod can be inserted and removed as many times as necessary without loss of pressure. The rod has a built-in faucet made of plastic.

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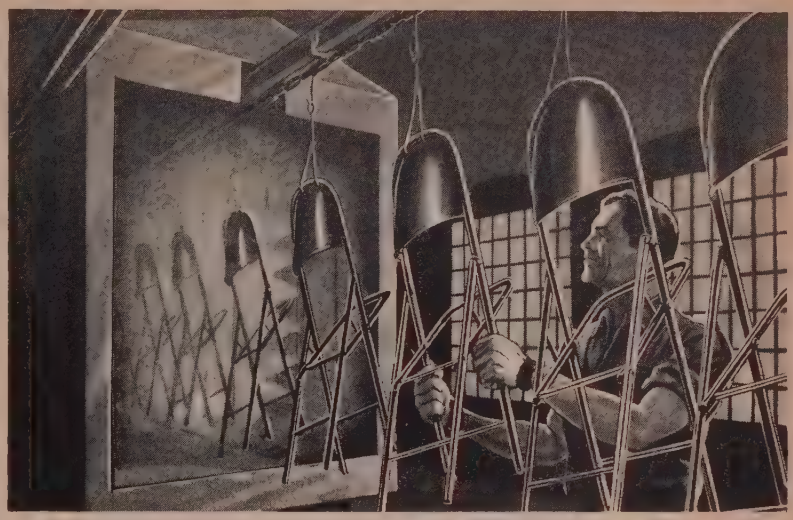

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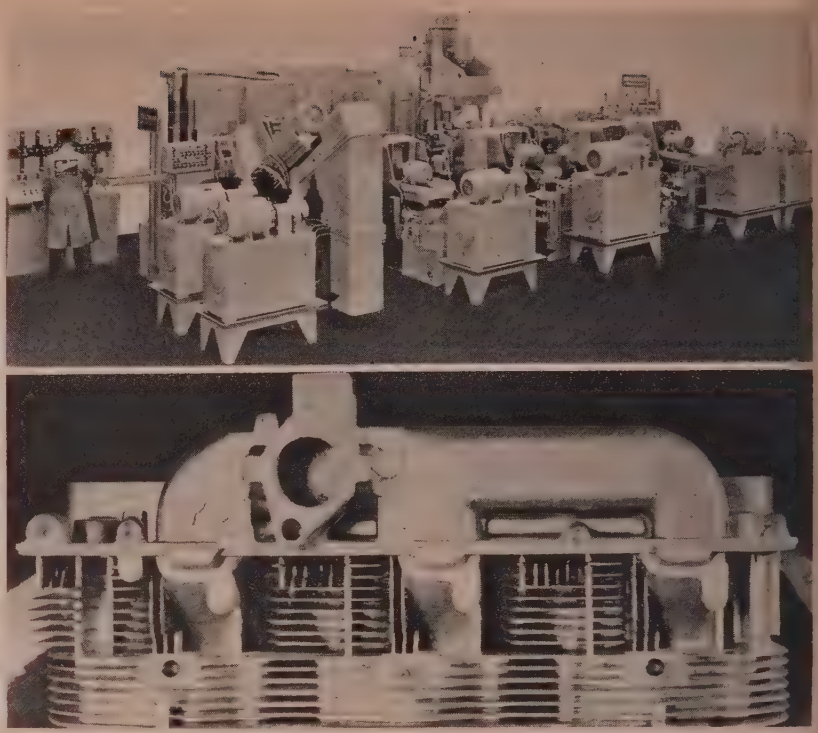

New Transfer Unit Built for GM Aluminum Engine

Buhr Machine Tool Co., Ann Arbor, Mich., has designed and built a new Economatic transfer machine for finishing the permanent-mold cast aluminum cylinder head for the Corvair engine. This machine is one example of how the smaller cars and light-weight alloys have affected machine tool design.

The machine itself is more compact than that needed for a cast iron cylinder head, but, proportionately, the reduction is nowhere near that of the new aluminum engine. The small machines have more power capacity than needed for machining aluminum, but provide high machining feeds and speeds.

Operations on the cylinder heads include drilling, chamfering, boring, reaming and tapping. To carry these out there are 17 working and idle stations. When designing these stations, the ease and speed in working aluminum as compared to cast iron was considered.

Cutting tools used in the machine were specifically designed for aluminum. These tools differ from those used for cast iron in that cutters and drills have polished flutes, drills have fast spirals, and tools are operated at higher speeds and feeds than would be the case with cast iron.

When the cylinder head is loaded into the transfer machine small holes are cored about half way through. The machine drills the remaining distance. Although the number of operations is not much reduced, the amount of work required to finish the parts is considerably less.

Bridgeport Brass Buys Rolling Mill

Bridgeport Brass Co. has taken title to a government-owned industrial reserve metal fabricating and machining plant in Warren, Ohio. The firm will use the facility for a fully-integrated aluminum mill.

The plant will begin operations on a re-roll basis only, but will eventually become an integrated mill with complete melting, casting and hot rolling facilities. The plant will represent a Bridgeport investment of $16 million to $18 million over the next five years.

Equipment was to have been installed as soon as arrangements were finalized. Initial production is expected to get underway about mid-summer. The first mill installed will be limited to producing 24-inch strip and the bulk of the firm's marketing efforts will be directed toward the sale of "fussy" items. A line for painted strip is also planned, as is equipment to produce sheet and strip up to 48 inches wide.

The facility occupies more than 19 acres, with the building covering 366,000 square feet. It was operated by the Navy in World War II, and during the Korean War.

Kenneth M. MacQuarrie, current manager of Bridgeport's Flemington, N. J., plant, will manage the Warren operation.

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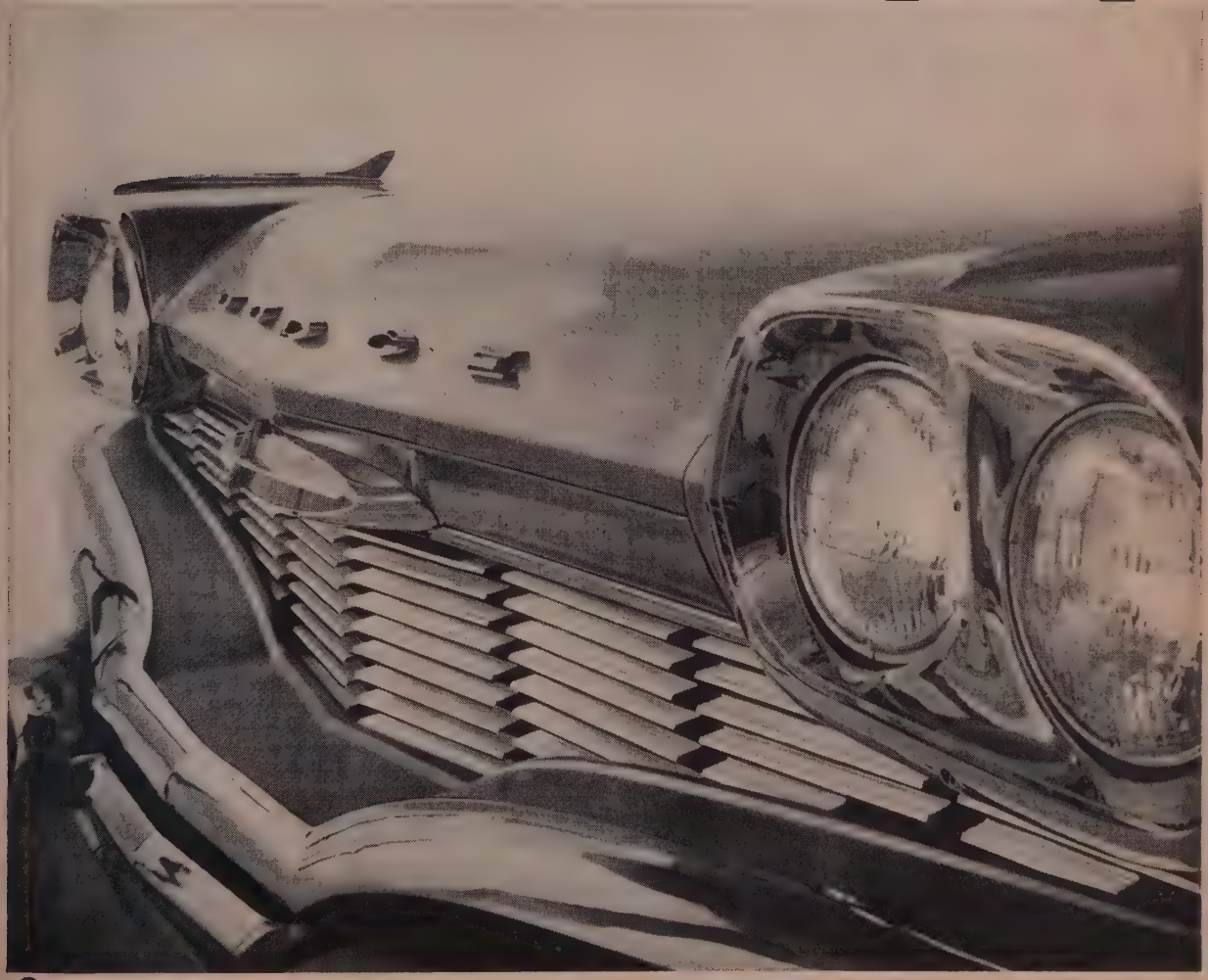

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Tubular Aluminum Crossarms Used in Transmission Towers

Tubular aluminum crossarms are being used on H-frame transmission towers by the Portland General Electric Co., who is constructing a 230-kv power line near Salem, Ore.

The installation comprises a total of 20 crossarms, including 41-foot tangent structure arms, and 36 and 25-foot angle structure arms. All were fabricated from extruded aluminum tube.

The electric company approved use of the crossarms after they had passed load tests at the Alcoa testing station at Lafayette, Ind.

This experimental use is the first such application of aluminum tube in the U. S. It is part of the utility's program to develop maintenance-free structures for its service area. In this instance, it is anticipated that repeated protective paintings and replacement of rot-deteriorated arms will be eliminated.

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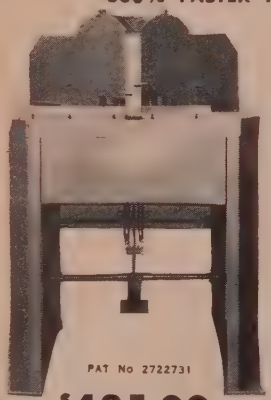

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New Honeycomb Core Produced for Missiles

Hexcel Products Inc., Berkeley, Calif., says its recently developed 5056 aluminum honeycomb core material is the strongest ever produced. The firm says current data indicates the new material is 15 to 30% stronger than any comparable product on today's market.

The 5056 alloy contains the same metals as Hexcel's 5052 honeycomb material, but percentage compositions have been varied—the most significant change being an increase in magnesium content.

The new honeycomb is being produced in cell diameters ranging from ⅛ to ⅜ inch and in foil gauges of 0.001 and 0.002 inch. Pieces will be available in sizes up to 28 by 96 inches. Full-scale production was slated to begin late in 1959.

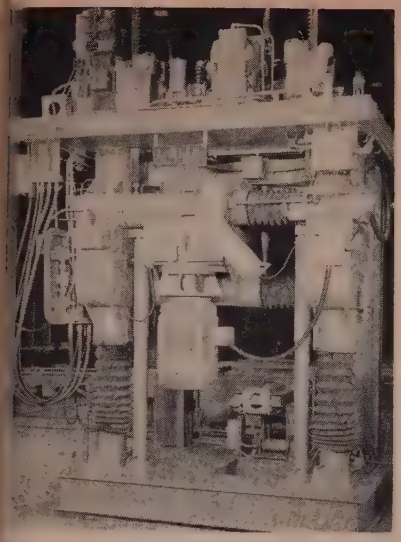
Aircraft and missiles are expected to be the main market for the new honeycomb but it will also find application in the packaging, construction, electronics and other industries.

Kaiser Forging Capacity Doubled at Erie

Doubled capacity has been obtained by the Forging Division, Kaiser Aluminum and Chemical Corp., Erie, Pa., through a $5 million plant expansion which includes five E. W. Bliss Co. hydraulic presses and five forging preheat furnaces.

Recently completed and housed in a new 53,000-square-foot building, the new facilities permit the forging division to handle a wide variety of nonferrous contract forging work, and to increase its output of aluminum alloy forgings.

Three of the hydraulic presses are of the water accumulator type and have 3000, 5000 and 8000-ton capacities (see cut). Two smaller units are oil hydraulic presses of 250 and 500-ton capacities, and are used for trimming work.



Continuous Casting Machine Produces Copper Billets

Loma Machine Mfg. Co., Inc., New York, has developed a fully continuous billet and slab casting machine that handles copper in all its forms — from phospher de-oxidized and oxygen-free to fire refined and tough pitch. The machine's design also lends itself to casting of aluminum and magnesium, and brasses and bronzes.

The machine is able to produce: round piercing and extrusion billets, square wire bars, and rectangular slabs. Capacity ranges from 3 tons per hour for double-strand casting of 3 inch diameter billets to 10 tons per hour for single-strand casting of 5½ by 33 inch slabs.

Liquid metal is fed into the machine from either an arc or induction melting furnace followed by an induction holding furnace. Molten copper then flows through a refractory-lined distributor equipped with down spouts which feed the metal into copper molds at the top of the machine.

One workman is needed to produce uniform, dense ingot structure from end to end plus a fine-grain even in large cross sections, says manufacturer.

Men-on-the-move

Farrel-Birmingham Co., Inc., Watson-Stillman Press Division, Rochester N. Y., has announced the appointment of **Stanley T. Bowden** as sales manager. He will direct the sale of Farrel Watson-Stillman hydraulic machinery for the plastics, metalworking, extrusion and general industries.

H. A. Curwen has been appointed to the new position of technical director for Earle M. Jorgensen Co., Los Angeles, steel and aluminum distributor. President Earle Jorgensen pointed out that a technical director is most important to a metals supplier, particularly in view of the increasing complexity of metallurgical problems and the critical demands placed on materials by design engineers. Curwen will be concerned with technical activities of all Jorgensen plants.

Aluminum Transatlantic Inc., New York, has announced the retirement of **Harry A. Hanson,** president and director of this distributing agency of British Aluminium Co. Ltd. Hanson's service with this company and its predecessor, Arthur Seligman & Co., dated back to 1922.

Dr. Walter A. Dean has been named assistant director of research for Aluminum Co. of America. He succeeds **William T. Ennor** who has retired. Dr. Dean joined Alcoa in 1929 and has served in many managerial and research capacities. He is a recognized authority on light metals alloy and process developments.

George Turney Bowman has been named manager of rolls sales at Hyde Park Foundry & Machine Co., Hyde Park, N. Y. He has been with Hyde Park for the past 14 years.

Aluminum Foils, Inc. has named **Thomas W. Allison** vice president in charge of marketing and sales.

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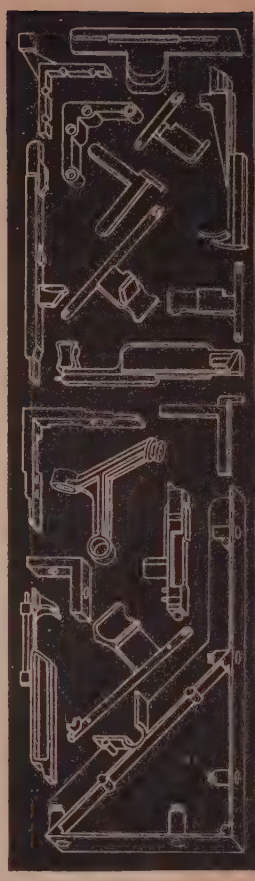

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Looking Ahead

Interesting to note post-strike comments by steel, aluminum and union men. When the aluminum industry settled, they said the overall package was lower than what the unions claimed they got. In the case of steel, they stated their new labor costs would be considerably higher than what union headquarters said the package contained. Guess it's just that the steel and aluminum companies use different kinds of arithmetic, assuming the unions use similar methods too in figuring both contracts. Kaiser Steel, the first to settle, apparently believes the other steel firms got the better deal because it wants to revise its contract along their lines. Sometimes it doesn't pay to be the early bird.

As for metal prices, aluminum men were smart to increase prices a few days before they settled because they couldn't have upped them at a time when the steel industry held the line. The reason steel didn't go up was because producers will sell all they can produce for six months anyway; will naturally make record-breaking profits. But look for increases on the least-competitive steel items after midyear. Items like tinplate for containers, roofing and siding, galvanized, etc., may not move up at all if competition with other materials remains as keen as it is currently.

Aluminum producers aren't, or haven't been, in this happy sold-out condition, and their price sheets became thoroughly demoralized during the past two years of silly price-slashing. Their earnings have been poor, and one producer even had to sell a lump of its capital stock to get working capital. So a basic price increase seemed justified, even if only to get back on the same earnings level that prevailed in the days before most mill products were cut via the commodity route.

The extrusion business, which fell off in November and December, had shown good improvement by mid-January, indicating an early end of the off-season. Most of the better extruders increased prices about two cents a pound and talk was that the entire industry would firm up prices and keep them there. So far, a half dozen either haven't raised prices or are offering 90-day protection at the old prices. So it's anybody's guess as to whether the extrusion industry will shout for some degree of stability. If they don't, a wonderful opportunity will be missed.

Billet price increases were a two-way stretch. Extruders who buy soft alloy billets (which includes nearly all of them) now pay only 0.8c per pound more, and thereby pick up a half cent advantage over their competitors who buy pig or ingot and cast their own billet. In other words, companies who cast billet for their own use or resale now pay 1.3c a pound more for primary metal, but only get 0.8c more for the billet. One large extruder said he can now buy billet as cheap as he can cast it, particularly since the toll conversion of billet scrap is so high, and producers will take all of his plant-generated scrap. "Producers want the prime aluminum billet business," he said. "At these new prices, plus what they offer for scrap, they'll surely get the bulk of it."

Three window firms, in a surprise move, upped aluminum and door prices 10% last month. Arnold-Altex, tired of the industry price-cutting spree and admitting they weren't making money, sent a letter to customers stating that new prices would be effective January 1st; hoped that other window outfits would follow suit. Miami Window, also aching for a fair return on its investment, made a similar announcement. We understand that Superior Window, also of Miami, increased its prices too. While it's hard to believe that many window outfits will follow suit, even a slightly more stable window industry would erase much of the extruders' problem. Maybe it's something for extruders to promote.

The magnesium industry looks for a 10 to 15% business increase this year. Consumption last year amounted to 55,000 tons, up 25% over 1958. Mill products were up 24%, while sales of castings increased 5%. Magnesium will lose some business due to the aircraft stretchout; will pick up some from the missile program. Demand for sand castings is off, while die casting use is slated to increase. Also on an up-turn is demand for extrusions. In commercial products, increased demand is expected for tooling plate, materials handling equipment and photoengraving plates. The addition of a new primary magnesium producer last year should also help stimulate demand.

If cars move well in 1961, they will consume well over 300,000 tons of aluminum. One reason: New compact cars by Oldsmobile, Pontiac and Buick with aluminum engines. If the engine trend spreads you can expect aluminum use in autos to jump to 700,000 tons within five years. New aluminum uses in '61 may include extruded bumpers, die cast dashboards, and a V-4 small engine by Ford. Die casting dies for an aluminum engine are being tested by Chrysler. It may appear in the 1961 models. American Motors' small English car (Metropolitan) may go to an aluminum block, plus other major parts in '61. Talk is that Doehler-Jarvis is tooling up to die cast enough parts to make 240,000 six cylinder engines; will use 11,500 tons of aluminum for American Motors. Obviously, all auto firms have responded well to the aluminum producers' expansive promotional programs.

— The Editors

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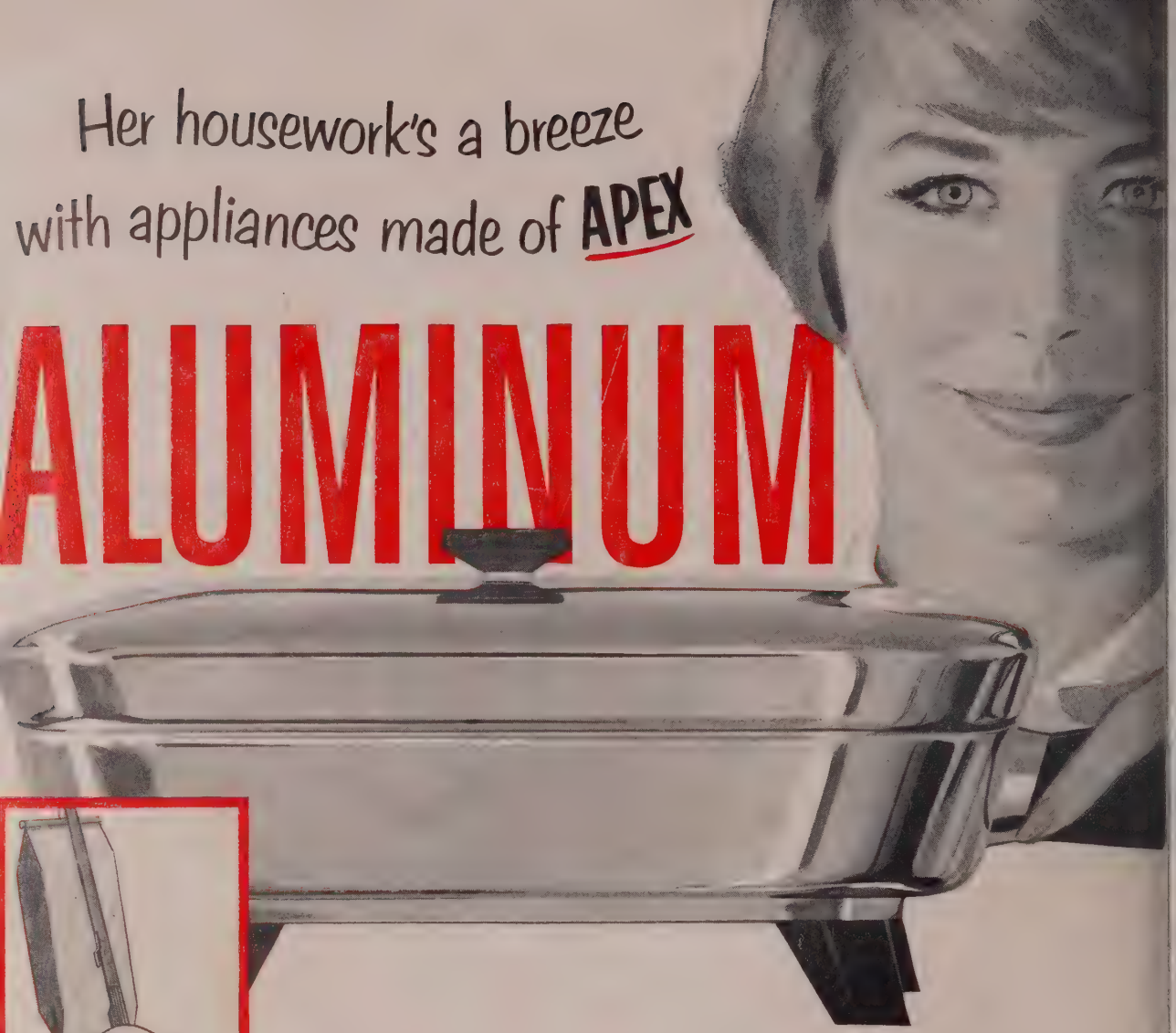

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